

SD750FR

HARDWARE AND INSTALLATION MANUAL



4Q REGENERATIVE ACTIVE FRONT END DRIVE

SD750FR

LOW VOLTAGE VARIABLE SPEED DRIVE

Hardware and Installation Manual

Regenerative Variable Speed Drive

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ABOUT THIS MANUAL

PURPOSE

This manual contains important instructions for the installation, configuration and use of Power Electronics SD750FR variable speed drives.

Power Electronics reserves the right to modify product features.

TARGET AUDIENCE

This manual is intended for qualified customers who will install, configure and operate Power Electronics SD750FR variable speed drives.

Only qualified technical personnel validated by Power Electronics may install and start up the drives.

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REFERENCE MANUALS

The following reference documents are available for this equipment:

- SD750FR Hardware and Installation Manual.
- SD750FR Programming and Software Manual.
- Pumps Application Manual.

POWER ELECTRONICS CONTACT INFORMATION

Power Electronics España, S.L.
Polígono Industrial Carrases
Ronda del Camp d'Aviació nº 4
46160, Lliria (Valencia)
ESPAÑA
Teléfono: (+34) 96 136 65 57
Página web: www.power-electronics.com

Power Electronics USA Inc.
1510 N. Hobson Street, Gilbert,
Phoenix
AZ 85233
ESTADOS UNIDOS DE AMÉRICA
Ventas US: 602-354-4890 / (480) 519-5977

REVISIONS CONTROL

DATE (DD/MM/YYYY)	REVISION	DESCRIPTION
26 / 05 / 2021	A	First edition.
27 / 05 / 2021	B	Misprints correction.
16 / 12 / 2021	C	Acronyms. Configuration table & standard ratings. Dimensions. Mechanical installation. Power connection. Control connection. Commissioning. Accessories. Misprints correction.

The equipment and technical documentation are periodically updated. Power Electronics reserves the right to modify all or part of the contents of this manual without previous notice. To consult the most updated information of this product, you may access our website www.power-electronics.com, where the latest version of this manual can be downloaded. The reproduction or distribution of the present manual is strictly forbidden, unless express authorization from Power Electronics.

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ACRONYMS

The terms commonly used in the documentation of Power Electronics' products are listed in the table below.

Please notice this is a general series of terms and it encompasses all our product divisions (industrial, solar, storage, and electric mobility), thus, some of the following expressions may not apply to this particular manual.

ACRONYM	MEANING
AASS	Auxiliary Services
AC	Alternating Current
AI	Analogue Input
AO	Analogue Output
BESS	Battery Energy Storage System
BMS	Battery Manager Solution
CCID	Charge circuit interrupting device
CCL	Charge Current Limit.
CCS	Combined charging system – charging and communications protocol following the standard IEC 61851-23 Annex CC
CHAdEMO	Charging and communications protocol following the standard IEC 61851-23 Annex AA
CPU	Central Processing Unit
DC	Direct Current
DCL	Discharge Current Limit
DI	Digital Input
DSP	Digital Signal Processor
DO	Digital Output
EMS	Energy Management System
EV	Electric Vehicle
FPGA	Programmable device (Field-Programmable Gate Array)
FRU	Field Replaceable Unit
GFDI	Ground Fault Detector Interrupter
GPRS	General Packet Radio Services, a data transmission system
HVAC	Heating, Ventilation, and Air Conditioning
IGBT	Insulated Gate Bipolar Transistor
IMI	Insulation monitoring device
IT	Grid system where the power supply is kept isolated and the electrical equipment system is grounded.
LOTO	Lock Out – Tag Out
MCB	Miniature Circuit Breaker
MPCS	Multi Power Conversion System
MID	Measuring Instrument Directive
MV	Medium Voltage. This term is used to refer to high voltage in general
PE	Ground connection
PI	Proportional and Integral
POI	Point Of Interconnection
PPE	Personal Protection Equipment

ACRONYM	MEANING
PV	Photovoltaic energy
RCD	Residual Current Device
RCM	Residual Current Monitor
RFID	Radio Frequency Identification
SOC	State Of Charge – referred to battery
SOH	State Of Health – referred to battery. It compares the actual state of the battery to its initial conditions. It is measured in percentage
STO	Safe Torque Off
TN	Grid system where the power supply is grounded, and the electrical equipment system is brought to the same ground through the neutral connector.
TT	Grid system where both the power supply and the electrical devices are connected to the ground via separate connections
UPS	Uninterruptible Power Supply
VSD / VFD	Variable Speed Drive, Variable Frequency Drive. Both terms are used

SAFETY SYMBOLS

Always follow safety instructions to prevent accidents and potential hazards from occurring.

In this manual, safety messages are classified as follows:



WARNING

Identifies potentially hazardous situations where dangerous voltage may be present, which if not avoided, could result in minor personal injury, serious injury or death.

Be extremely careful and follow the instructions to avoid the risk of electrical shocks.



CAUTION

Identifies potentially hazardous situations, which if not avoided, could result in product damage, or minor or moderate personal injury.

Read the message and follow the instructions carefully.



NOTICE

Identifies important measures to take in order to prevent damage equipment and warranty lost, as well as encouraging good use and environmental practices.

Other symbols used in this manual for safety messages are the following:



Hot surface. Be careful and follow the instructions to avoid burns and personal injuries.



Risk of fire. Be careful and follow the instructions to prevent causing an unintentional fire.



Caution, risk of electric shock. Energy storage timed discharge. Wait for the indicated time to avoid electrical hazards.



Caution, risk of hearing damage. Wear hearing protection.

SAFETY INSTRUCTIONS

IMPORTANT!

Read carefully all documentation before manipulating the equipment and pay special attention to safety recommendations to maximize the performance of this product and to ensure its safe use and installation.

It is the installer's responsibility to follow the instructions provided on this manual, to follow good electrical practices and to identify all mentioned warnings and recommendations before starting up and operating the SD750FR.



WARNING

Do not remove the cover while the drive is powered or running.

Otherwise, you may get an electric shock.

Do not run the drive with the front cover removed.

Otherwise, you may get an electric shock.

The drive does not remove the voltage from the input terminals of the drive. Before working on the drive, isolate the whole drive from the supply.

If you do not remove the power supply, you may get an electric shock.

Do not remove the cover except for periodic inspections or wiring, even if the input power is not applied.

Otherwise, you get an electric shock.

Operate the drive with dry hands.

Otherwise, you may get an electric shock.

Do not use cables with damaged insulation.

Otherwise, you may get an electric shock.

Do not subject the cables to abrasions, excessive stress, heavy loads, or pinching.

Otherwise, you may get an electric shock.

Do not make any insulation or voltage withstand tests on the motor while the drive is connected.



WARNING



10 min

Both wiring and periodic inspections must be carried out at least 10 minutes after disconnecting the input power. To remove the front cover, make sure that the red "DC Link" LED is off. Then remove the metal cover from the terminals and check the following with a multimeter:

- Voltage between the output busbars U, V, W, and the cabinet is around 0V.
- Voltage between the terminals + HVDC, -HVDC and the cabinet is below 30VDC.

If you omit this recommendation, you may get an electric shock.



Even though multimeters have their own revisions Schedule, it is convenient to verify it works properly, specially to check voltage absence. It could be damaged and show incorrect values. Use a 1.5V battery to verify proper functioning.

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CAUTION

Install the drive on a non-flammable surface. Do not place flammable material nearby.

Otherwise, a fire could occur.



Disconnect the input power if the drive is damaged.

Otherwise, it could result in a secondary accident or fire.

Do not allow lint, paper, wood chips, dust, metallic chips, or other foreign matter into the drive.

Otherwise, a fire or accident could occur.



After stopping the drive, some of its parts will stay warm for a while. Wait for the drive to cool down for handling.

Touching hot parts may result in skin burns.



Do not apply power to a damaged drive or to a drive with parts missing, even if the installation is complete.

Otherwise, you may get an electric shock.



It is not allowed to weld the cabinet or structure; this could damage the sensitive electronic components inside the cabinet or structure.



NOTICE

RECEPTION

SD750FR drives are delivered tested and perfectly packed.

In the event of damage during transport, please ensure to notify the transport agency and POWER ELECTRONICS: 902 40 20 70 (International +34 96 136 65 57) or your nearest agent, within 24h from receiving the goods.

UNPACKING

Make sure model and serial number of the variable speed drive are the same on the box, delivery note and unit.

Each variable speed drive is delivered with Hardware and Software technical manuals.

RECYCLING

Packaging equipment must be recycled. Separate all different materials (plastic, paper, cardboard, wood...) and place them in the corresponding containers. Ensure waste collection is properly managed with a Non-Hazardous Waste Agent.



To guarantee health and natural environmental sources protection, the European Union has adopted the WEEE directive concerning discarded electric and electronic equipment (SEEA).

Waste of electrical and electronic equipment (WEEE) must be collected selectively for proper environmental management.

Our products contain electronic cards, capacitors and other electronic devices that should be separated when they are no longer functional. These WEEEs should be managed accordingly with a Hazardous Waste Agent.

Power Electronics promotes good environmental practices and recommends that all its products sold outside of the European Union, once they reach the end of their life, are separated and the WEEE managed according to the particular country applicable legislation (especially: electronic cards, capacitors, and other electronic devices).

If you have any questions about the electric and electronic equipment waste, please contact Power Electronics.

ELECTROMAGNETIC COMPATIBILITY (EMC)

The drive is intended to be used in industrial environment (Second Environment). It achieves compliance with category C3 defined in IEC/EN 61800-3 standard when the installation recommendations within this manual are followed. The driver can optionally operate in domestic environments (First Environment), complying with category C2 defined in IEC / EN 61800-3 standard. For category C1 consult Power Electronics. Optional IT filter.

Select communication and control system according to the drive EMC environment. Otherwise, systems could suffer from interferences due to a low EMS level.

CAPACITORS DEPLETION

If the drive has not been operated for a long time, capacitors lose their charging characteristics and are depleted. To prevent depletion, once a year run the device under no-load conditions during 30-60 minutes.

SAFETY

- Before operating the drive, read this manual thoroughly to gain an understanding of the unit. If any doubt exists, please contact POWER ELECTRONICS, (902 40 20 70 / +34 96 136 65 57) or your nearest agent.
- Wear safety glasses when operating the drive with power applied or for when the front cover is removed.
- Handle and transport the drive following the recommendations within this manual.
- Install the drive according to the instructions within this manual and the local regulations.
- Do not place heavy objects on the drive.
- Ensure that the drive is mounted vertically and keeping the minimum clearance distances.
- Do not drop the drive or subject it to impact.
- The SD750FR drives contain static sensitive printed circuits boards. Use anti-static safety procedures when handling these boards.
- Avoid installing the drive in conditions that differ from those described in the Environmental Ratings section.

CONNECTION PRECAUTIONS

- To ensure a correct operation of the drive, it is recommended to use a SCREENED CABLE for the control wiring.
- The motor cable should comply with the requirements within this manual. Due to increased leakage capacitance between conductors, the external ground fault protection threshold value should be adjusted ad hoc.
- Do not disconnect motor cables if the input power supply remains connected.
- The internal circuits of the SD750FR Series will be damaged if the incoming power is connected and applied to output terminals (U, V, W).
- Do not use power factor correction capacitors banks, surge suppressors, or RFI filters on the output side of the drive. Doing so may damage these components.
- Always check whether the "DC Link" red LED is OFF before wiring terminals. The capacitors may hold high-voltage even after the input power is disconnected.
- Do not connect the drive in grids whose THDv is higher than 8%.

COMMISSIONING

- Verify all parameters before operating the drive. Alteration of parameters may be required depending on application and load.
- Always apply voltage and current signals to each terminal that are within the levels indicated in this manual. Otherwise, damage to the drive may occur.
- For correct starting, refer to the start-up section.

HANDLING PRECAUTIONS

- When the "Automatic Restart" function is selected, observe the appropriate safety measures to avoid any damage in case of sudden restart of the motor after an emergency and subsequent reset.
 - The "STOP / RESET" key on the driver's own keypad will be operative as long as this option has been selected. By pressing this button, the drive will not perform an emergency stop. The driver has a STO function which, installed with an external EMERGENCY pushbutton, will disconnect the motor power supply and prevent the ability to generate torque in the motor.
 - If an alarm is reset without having lost the reference signal (setpoint), an automatic start may occur. Check that the system has not been configured as such. Failure to do so could result in personal injury.
 - Do not modify anything inside the driver without the supervision of Power Electronics.
 - Before starting the parameter setting, reset all parameters.
-

EARTH CONNECTION

- Ground the drive and adjoining cabinets to ensure a safe operation and to reduce electromagnetic emission.
 - Connect the input PE terminal only to the dedicated PE terminal of the drive. Do not use the case, nor chassis screw for grounding.
 - Ground the drive chassis through the labelled terminals. Use appropriate conductors to comply with local regulations. The ground conductor should be connected first and removed last.
 - Motor ground cable must be connected to the PE output terminal of the drive and not to the installation's ground. We recommend that the section of the ground conductor (PE) is equal or greater than the active conductor (U, V, W).
 - If the user decides to use screened motor cable, ensure a good 360° connection of the cable screen in both the drive cabinet and the motor terminal box.
-

CYBER SECURITY DISCLAIMER

This product is designed to be connected to and to communicate information and data via a network interface. The customer is the sole responsible for providing and continuously ensuring a secure connection between the product and customer network or any other network (as the case may be). Customer shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of antivirus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Power Electronics and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

TORQUE AND SCREW SIZING

The following table shows, broadly speaking, the recommended tightening torque for both mechanical and electrical connections, applicable to all cabinets ^[1, 2]:

SCREW SIZE		RECOMMENDED TORQUE			
METRIC (mm)	ENGLISH (inches)	DIN (Nm)		ASTM (ft*lb)	
		6,9 QUALITY ^[a]	8,8 QUALITY ^[a]	A449 TYPE 1 ^[a]	A325 TYPE 1 ^[a]
M3	1/8	1	1,3	-	
M4	5/32	2,5	3		
M5	3/16	4	6		
M6	1/4	5	10	4	-
M8	5/16	20	25	9	
M10	7/16	40	50	25	50 – 58
M12	1/2	60	70	38	
M14	9/16	100	120	54	-
M16	5/8	150	210	75	99 – 120

[a] For other qualities, follow the screw's manufacturer guidelines.



CAUTION

For all screwing that hold a **particular component** such as a bus, contactor, etc. it will be necessary to **apply the tightening torque indicated by the manufacturer** of the same component.

Screwing should be tightened correctly only when necessary, i.e. when the factory marks are not in place. For small screws that do not have marks, the good electrical praxis will determine if it is loose.

¹ Power Electronics recommends the use of **Zinc Steel quality 8.8 bolts for internal connections** in general, DC and earth connections included.

² Power Electronics recommends the use of **A2-70 stainless bolts for external connections** in general, AC connections included.

1.INTRODUCTION

1

SD750FR Series goes one step ahead keeping the family unique characteristics. Based on the latest Active Front End technology, they are able to: regenerate the braking energy, reduce the THDi<5%¹, adjust the cosine phi and keep it constant at any load condition, and keep the motor voltage constant even when high input voltage drops occur.



¹ Harmonics are below the limits defined in IEEE519 for all ISC/IL.

2. CONFIGURATION TABLE & STANDARD RATINGS

2

Configuration table

To consult the configuration table of SD750FR drives manufactured by Power Electronics, please refer to the latest brochure (visit <http://www.power-electronics.com>).

Standard ratings

Voltages in the standard ratings shown in the following tables are the three-phase input voltages for the drive.

The number of pulses depend on the number of transformer secondaries at drive input.

- 6 pulses: Transformer with a single secondary.

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400Vac

FRAME	CODE	OPERATION TEMPERATURE 40 °C NORMAL DUTY			OPERATION TEMPERATURE 50 °C HEAVY DUTY			OVERLOAD (A)
		Motor Power (kW)	Motor Power (hp)	I(A) Rated	Motor Power (kW)	Motor Power (hp)	I(A) Rated	
5	SD75F0260 5BCD	132	200	260	110	150	210	315
	SD75F0320 5BCD	160	250	320	132	200	250	375
	SD75F0340 5BCD	200	270	340	150	220	275	413
6	SD75F0400 5BCD	220	300	400	160	250	330	495
	SD75F0450 5BCD	250	350	450	220	300	370	555
	SD75F0570 5BCD	315	400	570	250	350	460	690
7	SD75F0700 5BCD	400	550	700	315	450	580	870
	SD75F0800 5BCD	450	650	800	355	500	650	975
	SD75F0900 5BCD	500	700	900	400	550	720	1080
8	SD75F1050 5BCD	560	800	1050	450	700	840	1260
	SD75F1140 5BCD	630	900	1140	500	750	925	1388
	SD75F1230 5BCD	710	940	1230	560	800	990	1485
9	SD75F1400 5BCD	800	1000	1400	630	900	1150	1725
	SD75F1550 5BCD	900	1250	1550	710	1000	1260	1890
10	SD75F1800 5BCD	1000	1400	1800	800	1150	1440	2160
	SD75F1950 5BCD	1100	1500	1950	900	1250	1580	2370
	SD75F2250 5BCD	1200	1750	2250	1000	1450	1800	2700
11	SD75F2750 5BCD	1500	2200	2750	1200	1750	2200	3300
	SD75F3100 5BCD	1750	2450	3100	1400	2000	2500	3750

440Vac

FRAME	CODE	OPERATION TEMPERATURE 40 °C NORMAL DUTY			OPERATION TEMPERATURE 50 °C HEAVY DUTY			OVERLOAD (A)
		Motor Power (kW)	Motor Power (hp)	I(A) Rated	Motor Power (kW)	Motor Power (hp)	I(A) Rated	
5	SD75F0260 5BCD	132	200	236	110	150	191	286
	SD75F0320 5BCD	160	250	291	132	200	227	341
	SD75F0340 5BCD	200	270	309	150	220	250	375
6	SD75F0400 5BCD	220	300	364	160	250	300	450
	SD75F0450 5BCD	250	350	409	220	300	336	505
	SD75F0570 5BCD	315	400	518	250	350	418	627
7	SD75F0700 5BCD	400	550	636	315	450	527	791
	SD75F0800 5BCD	450	650	727	355	500	591	886
	SD75F0900 5BCD	500	700	818	400	550	655	982
8	SD75F1050 5BCD	560	800	955	450	700	764	1145
	SD75F1140 5BCD	630	900	1036	500	750	841	1262
	SD75F1230 5BCD	710	940	1118	560	800	900	1350
9	SD75F1400 5BCD	800	1000	1273	630	900	1045	1568
	SD75F1550 5BCD	900	1250	1409	710	1000	1145	1718
10	SD75F1800 5BCD	1000	1400	1636	800	1150	1309	1964
	SD75F1950 5BCD	1100	1500	1773	900	1250	1436	2155
	SD75F2250 5BCD	1200	1750	2045	1000	1450	1636	2455
11	SD75F2750 5BCD	1500	2200	2500	1200	1750	2000	3000
	SD75F3100 5BCD	1750	2450	2818	1400	2000	2273	3409

EN

480Vac

FRAME	CODE	OPERATION TEMPERATURE 40 °C NORMAL DUTY			OPERATION TEMPERATURE 50 °C HEAVY DUTY			OVERLOAD (A)
		Motor Power (kW)	Motor Power (hp)	I(A) Rated	Motor Power (kW)	Motor Power (hp)	I(A) Rated	
5	SD75F0260 5BCD	132	200	217	110	150	175	263
	SD75F0320 5BCD	160	250	267	132	200	208	313
	SD75F0340 5BCD	200	270	283	150	220	229	344
6	SD75F0400 5BCD	220	300	333	160	250	275	413
	SD75F0450 5BCD	250	350	375	220	300	308	463
	SD75F0570 5BCD	315	400	475	250	350	383	575
7	SD75F0700 5BCD	400	550	583	315	450	483	725
	SD75F0800 5BCD	450	650	667	355	500	542	813
	SD75F0900 5BCD	500	700	750	400	550	600	900
8	SD75F1050 5BCD	560	800	875	450	700	700	1050
	SD75F1140 5BCD	630	900	950	500	750	771	1157
	SD75F1230 5BCD	710	940	1025	560	800	825	1238
9	SD75F1400 5BCD	800	1000	1167	630	900	958	1438
	SD75F1550 5BCD	900	1250	1292	710	1000	1050	1575
10	SD75F1800 5BCD	1000	1400	1500	800	1150	1200	1800
	SD75F1950 5BCD	1100	1500	1625	900	1250	1317	1975
	SD75F2250 5BCD	1200	1750	1875	1000	1450	1500	2250
11	SD75F2750 5BCD	1500	2200	2292	1200	1750	1833	2750
	SD75F3100 5BCD	1750	2450	2583	1400	2000	2083	3125

690Vac

FRAME	CODE	OPERATION TEMPERATURE 40 °C NORMAL DUTY			OPERATION TEMPERATURE 50 °C HEAVY DUTY			OVERLOAD (A)
		Motor Power (kW)	Motor Power (hp)	I(A) Rated	Motor Power (kW)	Motor Power (hp)	I(A) Rated	
5	SD75F0160 6BCD	132	200	160	110	150	130	195
	SD75F0180 6BCD	160	250	180	132	200	150	225
	SD75F0210 6BCD	200	300	210	160	250	170	255
6	SD75F0250 6BCD	250	350	250	200	300	210	315
	SD75F0310 6BCD	315	400	310	250	350	260	390
	SD75F0400 6BCD	355	450	400	315	400	320	480
7	SD75F0480 6BCD	450	600	480	355	450	385	578
	SD75F0570 6BCD	560	700	570	450	600	460	690
8	SD75F0680 6BCD	630	900	680	560	700	550	825
	SD75F0825 6BCD	800	1000	825	630	900	660	990
9	SD75F0930 6BCD	900	1200	930	800	1000	750	1125
	SD75F1050 6BCD	1000	1400	1050	900	1200	840	1260
10	SD75F1200 6BCD	1200	1600	1200	1000	1400	950	1425
	SD75F1400 6BCD	1400	1800	1400	1200	1600	1140	1710
	SD75F1550 6BCD	1500	2000	1550	1400	1800	1270	1905
	SD75F1750 6BCD	1700	2200	1750	1500	2000	1420	2130
11	SD75F1850 6BCD	1800	2400	1850	1700	2200	1500	2250
	SD75F2200 6BCD	2100	2750	2200	1800	2400	1800	2700

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3. TECHNICAL CHARACTERISTICS

3

INPUT	Power range ^[1]	132kW – 2200kW	
	Voltage range	380 – 480 Vac ($\pm 10\%$), 690 Vac ($-5/+10\%$)	
	Input frequency	50Hz/60Hz ($\pm 6\%$)	
	Input rectifier technology	IGBT	
	Rectifier bridge switching frequency	2.8kHz	
	Displacement power factor (DPF = $\cos \phi$)	1 (factory settings) 0.90 leading... 0.90 lagging (adjustable)	
	Power factor (PF = $I_1/I_{rms} \cdot \cos \phi$)	≥ 0.98	
	Momentary power loss	> 2s (depending on the load inertia)	
	EMC input filter	Second environment (Industrial): (C3 Standard) First environment (Domestic): C2 (Optional). C1 consult Power Electronics Optional IT filter	
	Harmonics filter	LCL	
	Current THD (%)	< 3% / 5% ^[2]	
	Regenerative	Yes – 4 quadrant operation	
	OUTPUT	Output frequency ^[2]	0...599 Hz
Overload capacity		Constant torque: 150% during 60s at 50°C Variable torque: 120% during 60s at 40°C	
Efficiency (at full load)		$\geq 97\%$	
		V/Hz	
Control method		VECTOR CONTROL Open Loop. PWM speed control / torque, AVC: speed control / torque Close Loop (Encoder): PWM speed control / torque, AVC: speed control / torque PMSM I/f, sensorless and HEPOL (High Efficiency Performance Open Loop)	
Carrier frequency		4 a 8kHz – PEWave	
Output dV/dt filter		500 to 800V/ μ s ^[3]	
Output cable length ^[4]		USC 300m, SC 150m	
Dynamic brake		-	
ENVIRONMENTAL CONDITIONS		Operation ambient temperature	Minimum: -20°C
		Minimum: -20°C	Maximum: +40°C (Normal duty)
	Storage temperature	Minimum: -40°C Maximum: +70°C	
	Altitude	1000m	
	Power altitude derating ^[1]	>1000m, 1% PN (kW) per 100m; 4000m maximum (for higher altitude consult with Power Electronics)	
	Ambient humidity	<95%, non-condensing	
	Degree of protection	IP54 ^[5] , IP42 ^[6] , Marine series adapted (IP44/IP54, under request)	
	Vibration	Amplitude: ± 1 mm (2Hz-13.2Hz), ± 0.075 mm (13.2Hz-57Hz) Acceleration: 6.86m/s ² (13.2Hz-57Hz), 9.8m/s ² (57Hz-150Hz)	
Heating resistors	Optional		
PROTECTIONS	Motor protections	Rotor Locked, Motor overload (thermal model), Output current limit, Phase current imbalance, Phase voltage imbalance, Motor overtemperature (PT100 signal), Speed Limit, Torque Limit	
	Drive protections	IGBT's Overload, Input Loss, Low Input Voltage, High Input Voltage, DC Bus Voltage Limit, DC Bus Low Voltage, High Supply Frequency, Low Supply Frequency, IGBT Temperature, Heat-sink overtemperature, Power supply fault, Drive thermal model, Ground Fault, Software and Hardware fault, Analog Input signal loss (speed reference loss), Safe stop and emergency stop	

[1] Consult with Power Electronics for other configurations.

[2] THDi < 3% (THDv = 0%). Harmonics are below the limits defined in IEEE519 for all Isc / IL.

[3] For operation frequencies higher than 100Hz consult Power Electronics.

[4] SC: Shielded cable, USC: Unshielded Cable. Follow Power Electronics installation recommendations. For greater cable lengths, consult Power Electronics.

[5] Applicable to the electronics.

[6] For stand-alone models.

[7] Certification in process.

HARDWARE	Digital inputs	6 programmable, Active high (24Vdc). Isolated power supply
	Digital outputs	3 programmable changeover relays (250Vac, 8A or 30Vdc, 8A)
	Analogue input	3 programmable differential inputs: 0 – 20mA, 4 – 20mA, 0 – 10Vdc and ± 10 Vdc, PT100 (optically isolated)
	Analogue outputs	2 isolated programmable outputs: 0 – 20mA, 4 – 20mA, 0 – 10Vdc and ± 10 Vdc
	Encoder inputs (optional)	1 differential encoder input. Voltage inputs from 5 to 24Vdc
	User power supply	+24Vdc user power supply, (Max. 180 mA) regulated and short-circuit protected +10Vdc user power supply, (Max. 2 potentiometers R= 1 k Ω) regulated and short-circuit protected
	I/O Extension board (optional)	Digital I/O board: 5 Digital Inputs: Programmable inputs and active high (24Vdc). Optically isolated. 5 Digital Outputs: programmable multi-function relays. Analogue I/O board: 2 Analogue Inputs: Programmable and differential input. 2 Analogue Outputs: Programmable outputs in voltage / current.
	External power supply (optional)	24Vdc External Power Supply
COMMUNICATION	Standard hardware	USB port RS485 port Ethernet
	Optional hardware	Optical fiber Communication Cards
	Standard protocol	Modbus-RTU Ethernet (Modbus TCP)
	Optional protocol	Profibus-DP Ethernet IP ProfiNet
	Type	Removable
	Length	3 meters (optional)
CONTROL PANEL	Connection	USB
	Visualization leds	LED RUN: Motor receiving power supply LED FAULT: Flashing displays that a fault has occurred
	LCD display	LCD screen Keypad with 8 keys to control and configure the drive, start and stop / reset Independent memory
	Display information	Average current and 3-phase motor current
		Average voltage and 3-phase motor voltage
		Average input voltage and 3-phase input voltage
		3-phase motor input and output frequency
		DC Bus Voltage
		Drive Status
		Speed, Torque, Power, Power Factor of the motor
		Register of total and partial drive running time with reset function (hours)
		Register of total and partial drive energy consumption with reset function (kWh)
		Relay status
	Digital inputs / PTC status	
	Output comparator status	
	Analogue inputs and sensor values	
	Analogue outputs value	
Motor overload and equipment status		
Drive and rectifier temperature		
Fault history (last 6 faults)		
Others	Real time clock Perpetual calendar	

REGULATIONS	Certifications	CE, RCM, UL ^[7] , cUL ^[7] , marine certifications (under request)
	Electromagnetic compatibility	EMC Directive (2004 / 108 / CE)
		IEC / EN 61800-3
	Design and construction	LVD Directive (2006 / 95 / CE)
		IEC/EN 61800-2 General requirements
		IEC/EN 61800-5-1 Safety
		IEC/EN 60146-1-1 Semiconductor converters
IEC60068-2-6 - Vibration		
Functional safety	IEC/EN 61800-5-2 Safety Stop (STO)	

4. DIMENSIONS

4



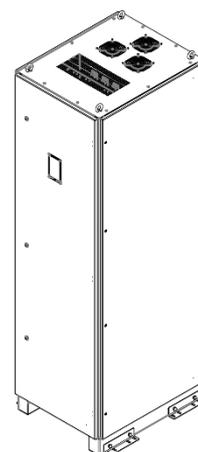
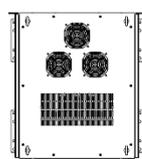
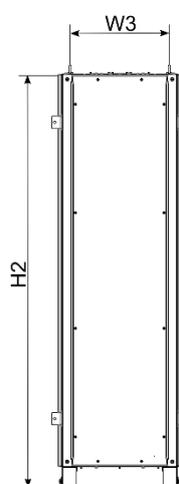
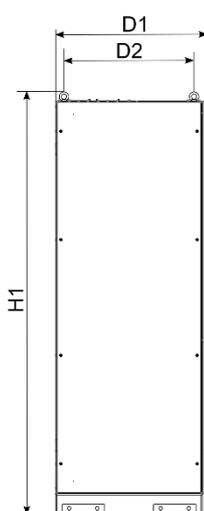
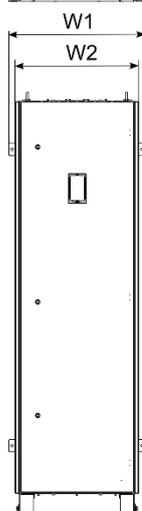
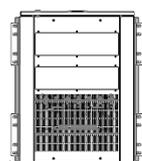
NOTICE

Consult drives input supply voltage in section "[Technical characteristics](#)".

Dimensions of frame 5

DIMENSIONS (mm)							WEIGHT (Kg)
W1	W2	W3	D1	D2	H1	H2	
655	595	475.6	730	625.6	2046	2001.5	350

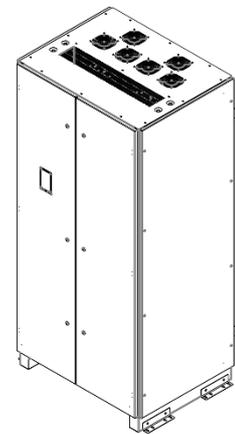
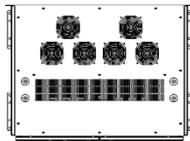
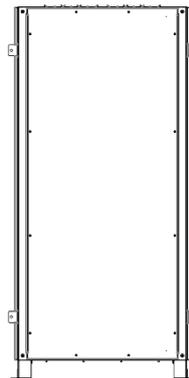
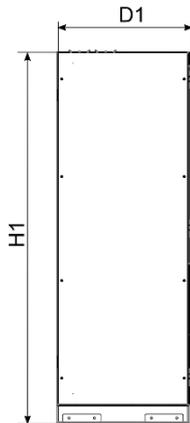
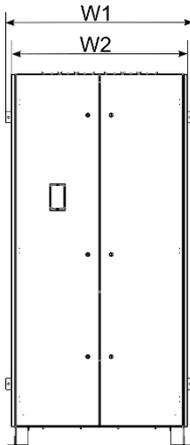
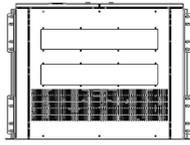
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SD75FRD001A

Dimensions of frame 6

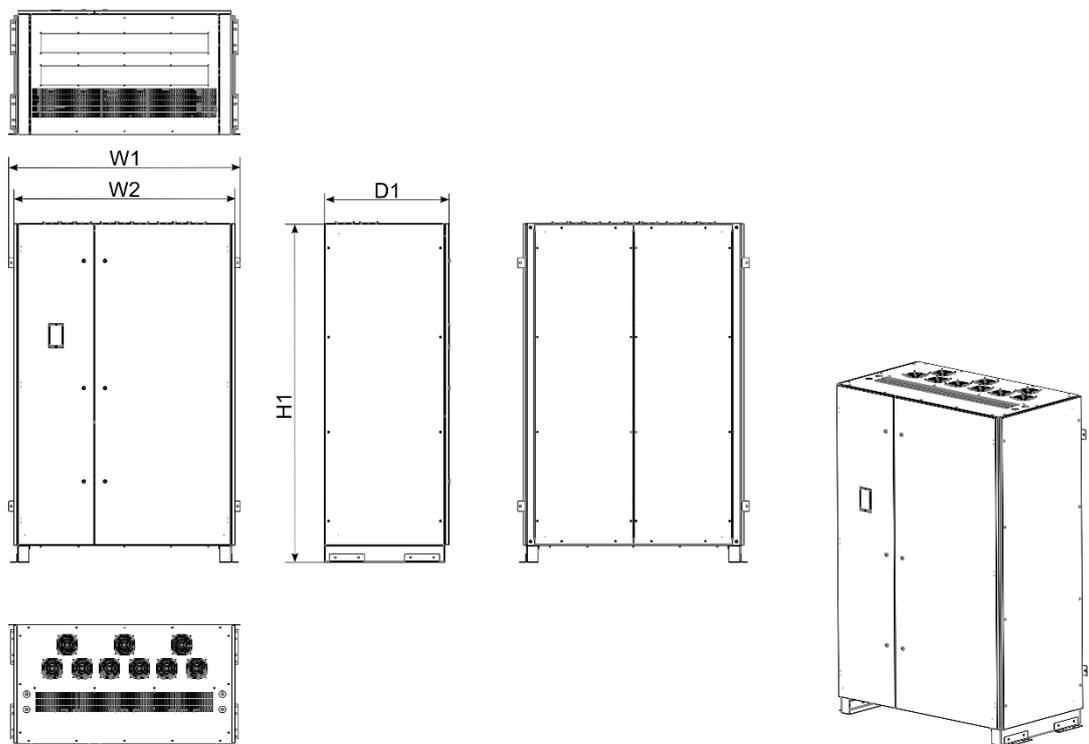
DIMENSIONS (mm)				WEIGHT (Kg)
W1	W2	D1	H1	
1003	943	730.2	2000.4	700



SD75FRDTD002A

Dimensions of frame 7

DIMENSIONS (mm)				WEIGHT (Kg)
W1	W2	D1	H1	
1354	1294	730.2	2000	1000

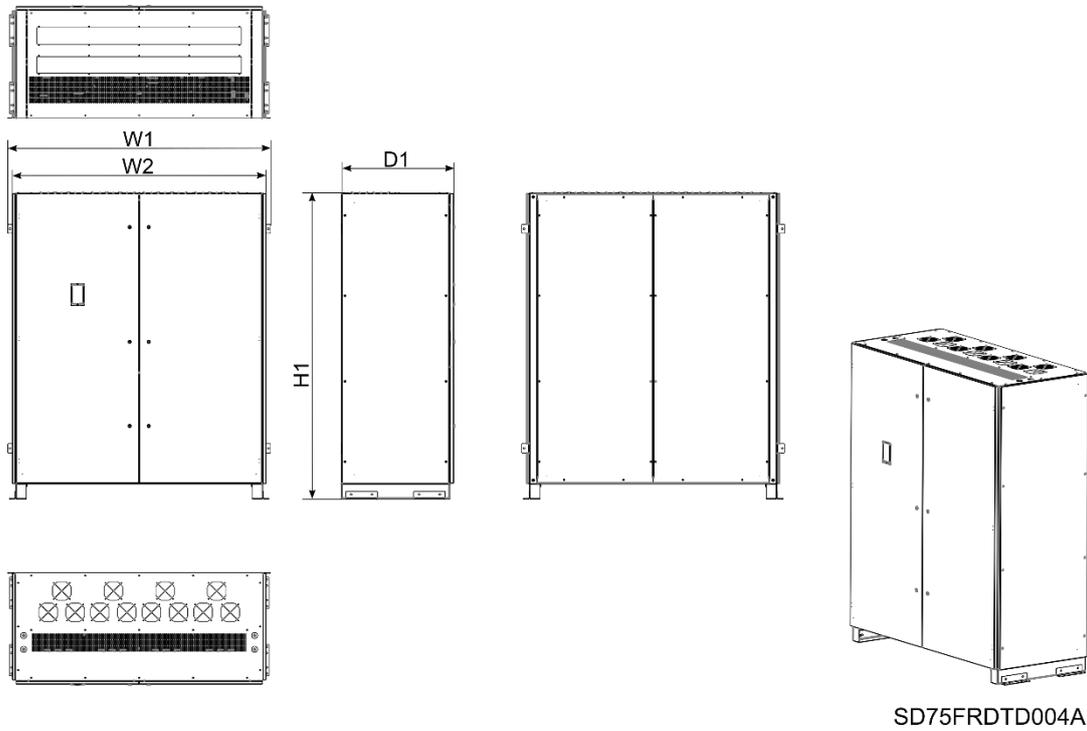


SD75FRDTD003A

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Dimensions of frame 8

DIMENSIONS (mm)				WEIGHT (Kg)
W1	W2	D1	H1	
1705	1646	730.2	2000	1200



Note: For frames over 8 consult with Power Electronics.

Dimensions of frame 9, 10 and 11

Frames 9 to 11 of SD750 are made up of several modules of smaller frames, depending on the power required by the customer. Therefore, the overall dimensions of the equipment will vary according to the number of modules and their size.

The possible combinations of the equipment are listed below, depending on the voltage and number of pulses. Additionally, the total width is shown for each case.

When installing the equipment, minimum safety distances must be taken into account. Consult section "[Clearances](#)".

400Vac – 480Vac

FRAME	CODE	COMBINATION	BASE MODEL CODE (INDIVIDUAL EQUIPMENT)	TOTAL WIDTH (W)
9	SD75F1400 5BCDE	2 x T7	SD75F0800 5BCDE	2710
	SD75F1550 5BCDE	2 x T7	SD75F0900 5BCDE	2710
10	SD75F1800 5BCDE	2 x T8	SD75F1050 5BCDE	3410
	SD75F1950 5BCDE	2 x T8	SD75F1140 5BCDE	3410
	SD75F2250 5BCDE	3 x T7	SD75F0900 5BCDE	4125
11	SD75F2750 5BCDE	3 x T8	SD75F1050 5BCDE	5175
	SD75F3100 5BCDE	3 x T8	SD75F1140 5BCDE	5175

525Vac – 690Vac

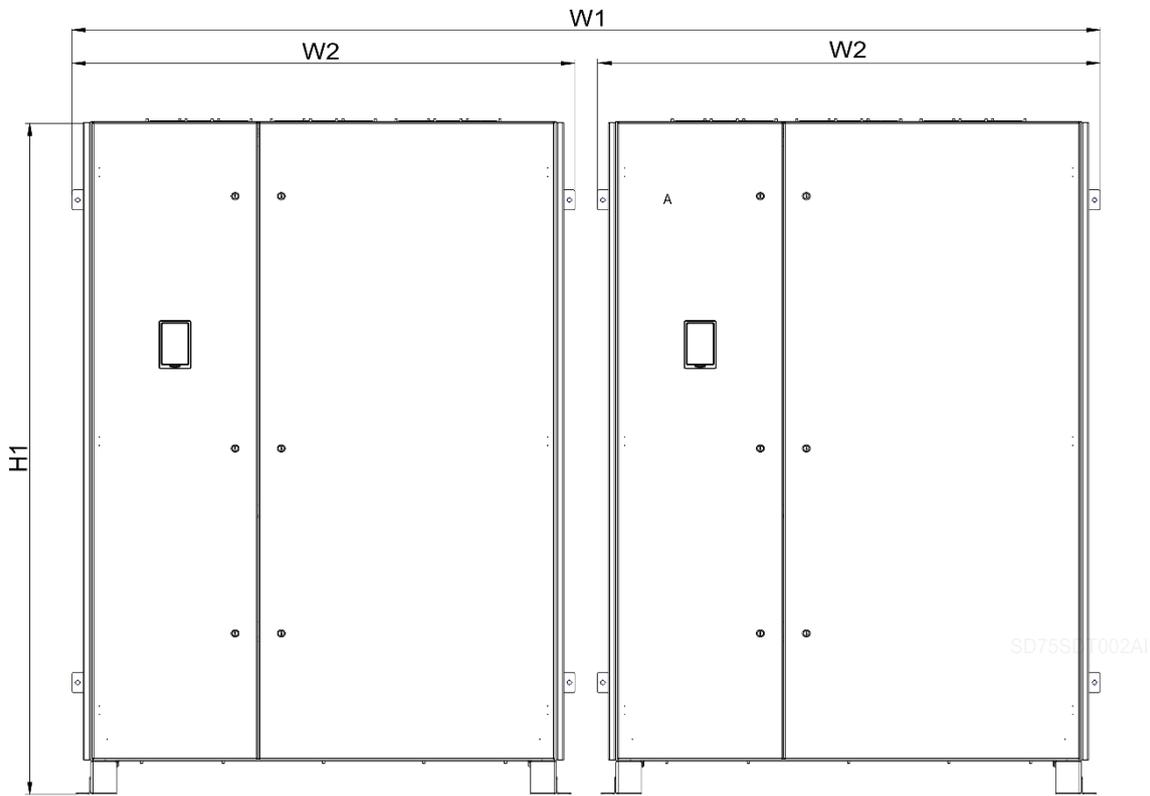
FRAME	CODE	COMBINATION	BASE MODEL CODE (INDIVIDUAL EQUIPMENT)	TOTAL WIDTH (W)
9	SD75F0930 6BCDE	2 x T7	SD75F0570 6BCDE	2710
	SD75F1050 6BCDE	2 x T7	SD75F0570 6BCDE	2710
10	SD75F1200 6BCDE	2 x T8	SD75F0680 6BCDE	3410
	SD75F1400 6BCDE	2 x T8	SD75F0825 6BCDE	3410
	SD75F1550 6BCDE	3 x T7	SD75F0570 6BCDE	4125
	SD75F1750 6BCDE	3 x T8	SD75F0680 6BCDE	5175
11	SD75F1850 6BCDE	3 x T8	SD75F0680 6BCDE	5175
	SD75F2200 6BCDE	3 x T8	SD75F0825 6BCDE	5175

Below are two configuration examples and their dimensions.

Example 1

SD750 frame 9 composed of two modules of frame 7.

DIMENSIONS (mm)		
H1	W1	W2
2000	2768	1354

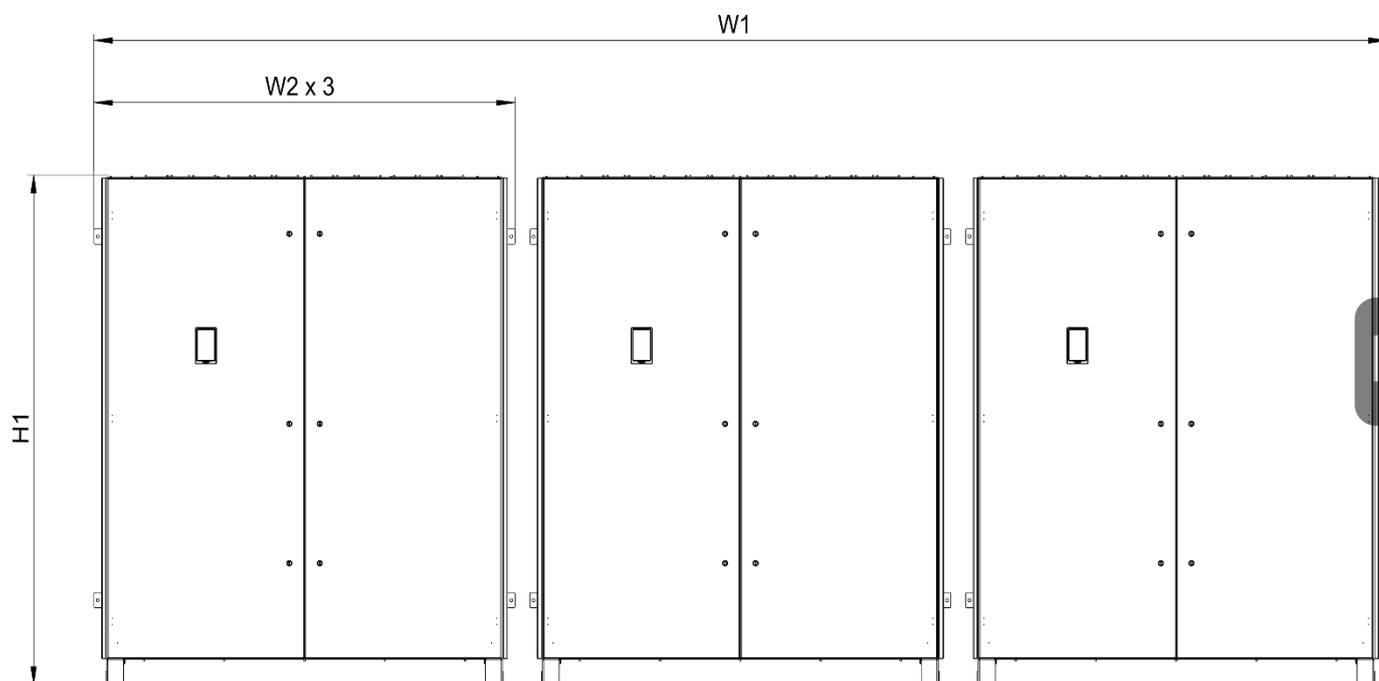


SD75FRD006A

Example 2

SD750 frame 11 composed of three modules of frame 8.

DIMENSIONS (mm)		
H1	W1	W2
2000	5235	1705



SD75FRDTD007A

5. RECEPTION, HANDLING AND TRANSPORTATION

5



CAUTION

Read carefully the following installation instructions for a correct mechanical installation.

Otherwise, the equipment can be damaged and lead to personal injury.

Reception

Power Electronics' equipment are carefully tested and packed for shipment. In the event of damage to the unit during transportation notify the transport agency and Power Electronics: 902 40 20 70 (International +34 96 136 65 57) or your nearest agent, within 24h from receipt of the goods.

Make sure model and serial number of the drive match the information on the delivery packing list.

The drive should be stored in a location that is protected from direct sun and moisture excess. The storage temperature rating for the drive is -40°C and $+70^{\circ}\text{C}$, < 95 RH without condensation. It is recommended not to stack more than two units.

Standard storage

In case the equipment is stored for a short period (up to 6 months) before its connection, the following rules will keep the unit safe until it is ready for installation:

- The equipment should be stored in a location that is protected from moisture (inside and outside the equipment).
- Avoid floodable grounds. No part of the equipment should ever be submerged under water.
- Temperature in the storage location must be kept between -40°C and $+70^{\circ}\text{C}$ (-40°F and $+158^{\circ}\text{F}$).
- Store unit on a flat, even surface.
- Store unit away from high traffic areas where the drive could get damaged.
- Make sure animals cannot get inside the unit.
- Keep doors closed and covers in place during storage.
- Store unit away from corrosive chemical products or gases.
- Keep the equipment packed until the moment of installation.

Extended storage

If the equipment is stored for an extended period (more than 6 months) before installation for an undefined date, new considerations should be taken, in addition to the recommendations in section [“Standard storage”](#).

- The drive must be stored in its original packaging.
- Draining bags shall be included inside the packaging to prevent moisture from damaging the equipment or its electronic components. These shall be replaced when storage conditions require it.
- Periodic inspections of the internal equipment status should be performed when possible. Proper internal cleanness must also be checked.
- To prevent deterioration of the capacitors, connect the equipment without load for 30-60 minutes once a year.
- Before commissioning, it is recommended to follow the instructions to connect power supply safely to the equipment. Please refer to document **VFIC001**.

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Handling and Transportation

Only the transport methods described in this document or in the delivery notes are permissible. Any other transport method or system could damage the unit.

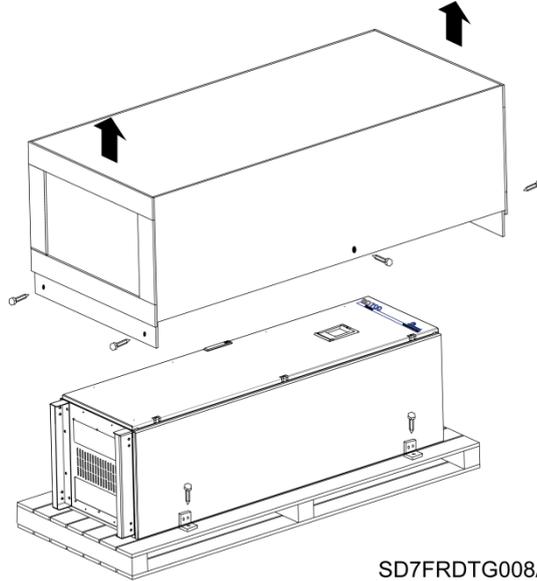
SD750FR is delivered vertically. Frames 1 and 2 are delivered in a cardboard box. From frame 3 they are delivered fastened to a wooden pallet. Frames 3 and 4 are covered with a cardboard box and from frames 5 with a wooden box. Depending on the method of transportation, the drive is supplied wrapped to be protected against dust. Place the entire pallet as close as possible to the installation site before removing the wooden box to prevent damage to the drive during transportation.

It is mandatory to carry the drive with a pallet truck, a forklift truck, or a crane, taking into account the load distribution and its center of gravity. Check the size and weight of the VFD to choose a proper equipment that can lift a higher weight.

Remove the drive packaging carefully (do not use sharp tools). After removing the packaging, please check the material inside. Verify that the number of items included in the package is in accordance with the inventory. In case of receiving spare parts with the product, please separate it and store it in a safe place. It should not be exposed to vibrations, falls or moisture.


CAUTION

If the weight of the load to be handled is greater than the maximum permissible weight of the crane, it could damage the equipment and personnel.



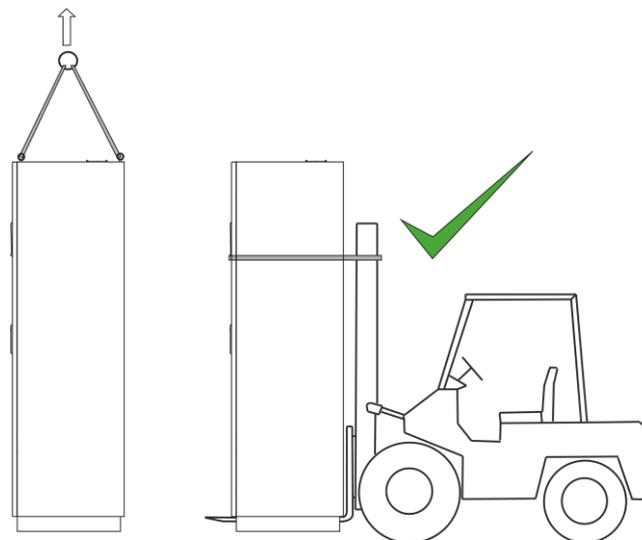
SD7FRDTG008A

To unpack, if necessary, unscrew the screws that fix the wooden box to the pallet. Then, unscrew the fixing screws on the angle brackets. To lift the drive and place it in a vertical position, use only a crane or a forklift equipped with straps or slings. Lift gently by pulling the top bolts.

To rise to an upright position, use only a crane or forklift equipped with belts or slings. Lift it carefully pulling from the top eyebolts.

Once the drive is upright, reinsert the straps / slings. The crane or forklift must always lift the drive from its bottom. Avoid sudden movements and blows during transportation. When placing the equipment on the ground, stop the lowering movement just before contacting the ground, and after this, lower it very slowly to avoid shocks.

In case of doubt about how to manipulate and transport equipment composed by several modules, consult Power Electronics.



SD75DTG0002A.

6. MECHANICAL INSTALLATION

6



CAUTION

The installation must be done by qualified personal.

Otherwise, the equipment can be damaged and lead to personal injury.

Before installation, make sure the location chosen is appropriate. There should be sufficient space to adapt the unit to the recommended distances and to ensure that there are no obstacles preventing the airflow from the fans.

Environmental ratings

Power Electronics recommends following the instructions in this manual carefully to ensure a correct operation of the drive. The installer is responsible for performing a proper installation in order to comply with the ambient conditions of the VFD. In addition, the installer is solely responsible for complying with the local regulations. The environmental conditions are:

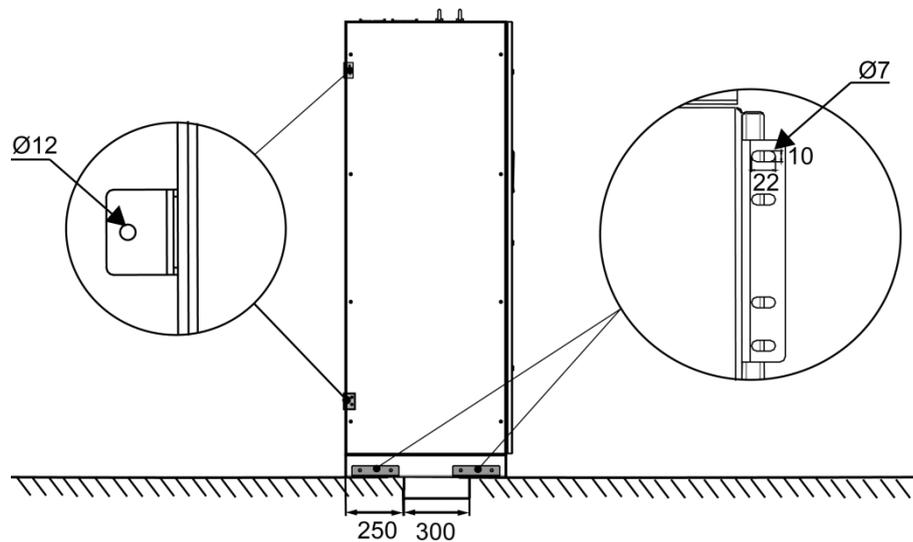
- Environmental category: Indoor
- Outdoor: No
- Pollution degree: Clean area: PD2
Dirty area: PD3
- Ingress protection rating: Clean zone: Electronics IP54 or IP20
Power connection and Input filters: IP20
- Operation Ambient temperature: -20°C to 50°C Heavy duty
-20°C to 40°C Normal duty
- Storage Ambient temperature: -40°C to 70°C
- Humidity: < 95% (non-condensing)
- Heating resistors: Optional
- Maximum altitude and power derating: 1000m 1% PN (kW) every 100m; 4000m maximum
- Vibration (IEC60068-2-6): Amplitude $\pm 1\text{mm}$ (2Hz – 13.2Hz), ± 0.075 (13.2Hz – 57Hz)
Acceleration 6.86m/s^2 (13.2Hz-57Hz), 9.8m/s^2 (57Hz-150Hz)
- Audible noise: < 79 dB
- Overvoltage category: III
- Protection class: Class 1
- Painting: Standard colour RAL 7035, other under request.

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Drive mounting

This section contains assembly instructions for optimum operation of the drive and precautions to avoid personal injury and property damage.

SD750FR drives are designed to be placed over a technical floor, vertically. The floor must guarantee a non-flammable, solid, plain and levelled surface to the drive, a minimum clearance around it and a smoothly cable access. The maximum allowed slope is 1cm in every 6 meters. If necessary, the installation site should be levelled, as the cabinet is not equipped with adjustable feet. The walls adjoining the drive must be made of a non-flammable material.



SD7FRDTG0009A

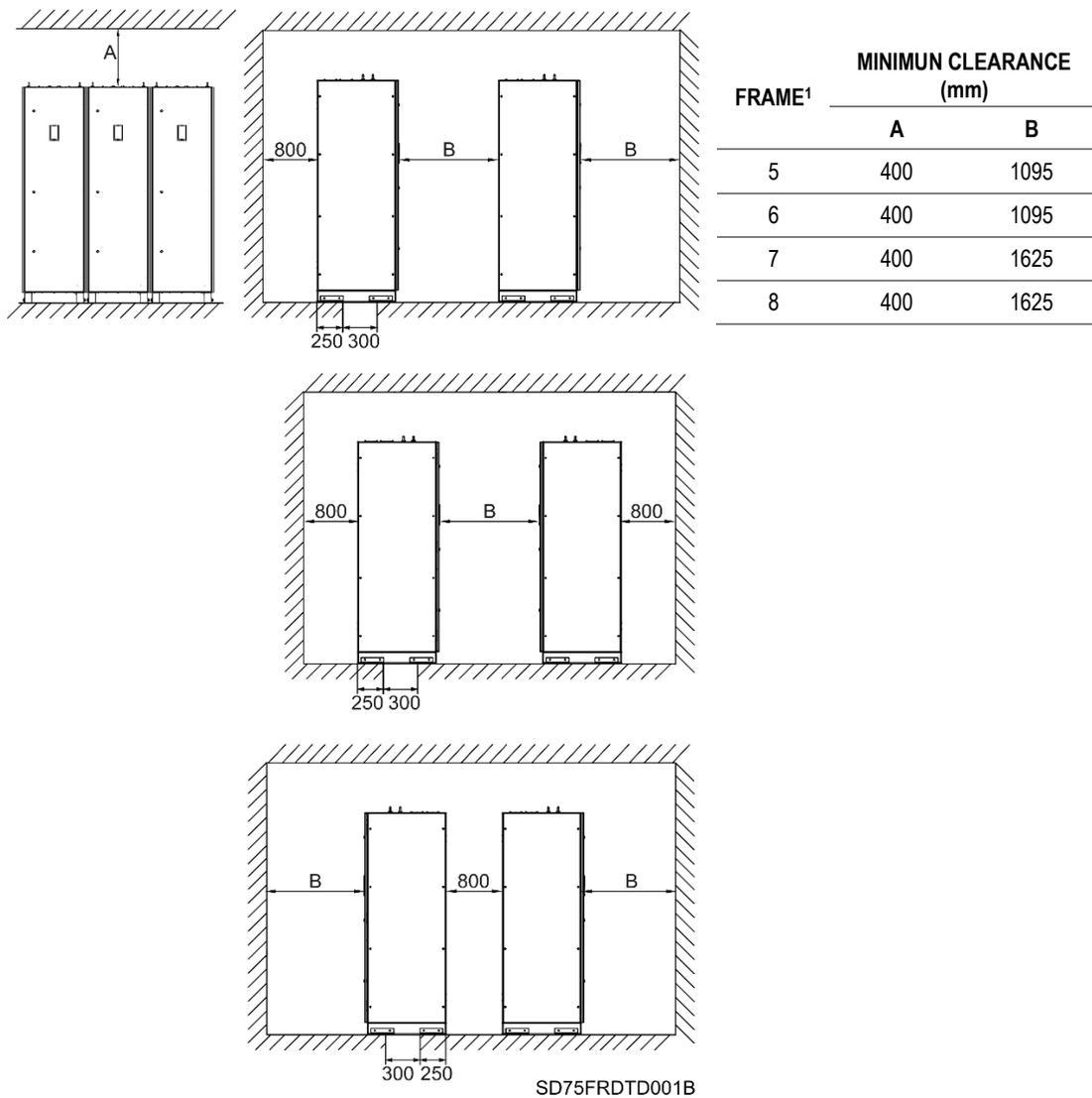
Fix the cabinets to the wall or floor by using the L brackets placed in both sides of the drive. They have an Ø12mm slot in the rear part and an Ø7mm slot in the legs of the drive.

It is recommended to construct a cable duct below the middle part of the cabinet. The duct width may not exceed 300 mm and the contact surface of the floor must resist the cabinet weight that lies on the legs. The duct begins at 250 mm from the rear part of the drive.

Clearances

Keep always the minimum passage width between the opened door of the SD750FR and the next fixed obstacle. The minimum passage width must comply with national standards. The recommended minimum passage width is 500 mm.

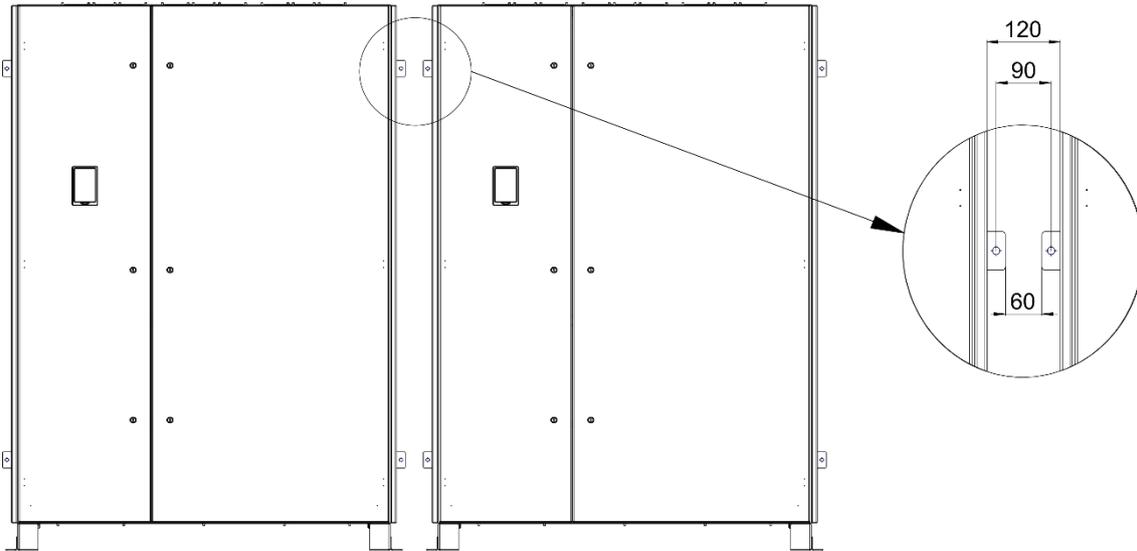
The cabinets can be installed against a wall or back-to-back with another unit in their rear and side parts. However, Power Electronics recommends keeping a minimum passage distance of 800mm in the rear part of the cabinet. The following figure and table show the clearances for all the SD750FR.



Note: It is recommended to have enough space in the front side of the equipment. The distance must be higher than the minimum distance in order to be able to move the equipment in case of need.

¹ For frames over 8 consult the clearances of its combinations. Consult the combinations in section "[Dimensions of frame 9, 10 and 11](#)".

In case of drives frame 9 to 11, they must be installed side-to-side and following the minimum distances between modules (values in mm).



SD75FRDTD007A

Cooling

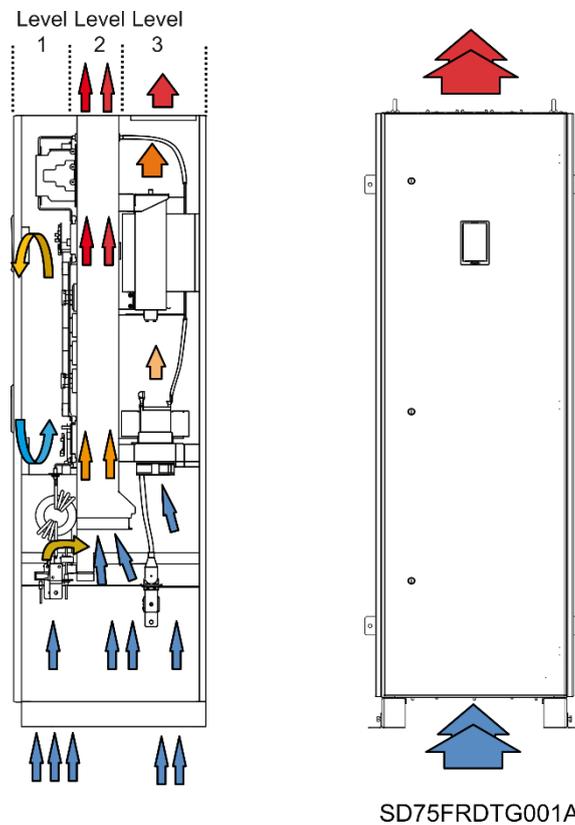
SD750FR drives integrate a variable speed system that varies the cooling flow depending on the IGBT temperature, increasing the fans' lifetime and their efficiency.

The heat sources inside the equipment correspond with the inverter and rectifier bridge (IGBTs), input filter and the output dV/dt filter. SD750FR series present an overall efficiency higher than 97% at rated power, so the heat dissipation approximately corresponds to 3% of the input power.

It is mandatory to keep all the inlet and outlet gratings of the drive without any obstacle that could reduce the cooling capacity of the drive.

The bottom metal panels must be mechanized to pass through them the power cables. It is forbidden to mechanize the bottom inlet gratings; otherwise, the drive could have a deficient cooling flow.

The cooling system of the drive depends on its degree of protection and its frame. In general terms, the drive has been designed with three independent cooling areas.



1st Area/Level - Electronics:

IP20 cabinets incorporate extractors in its upper part that evacuate the internal heat generated in the area.

IP54 cabinets keep electronic components fully sealed. The internal heat generated is evacuated through the metal doors thanks to an internal forced convection system.

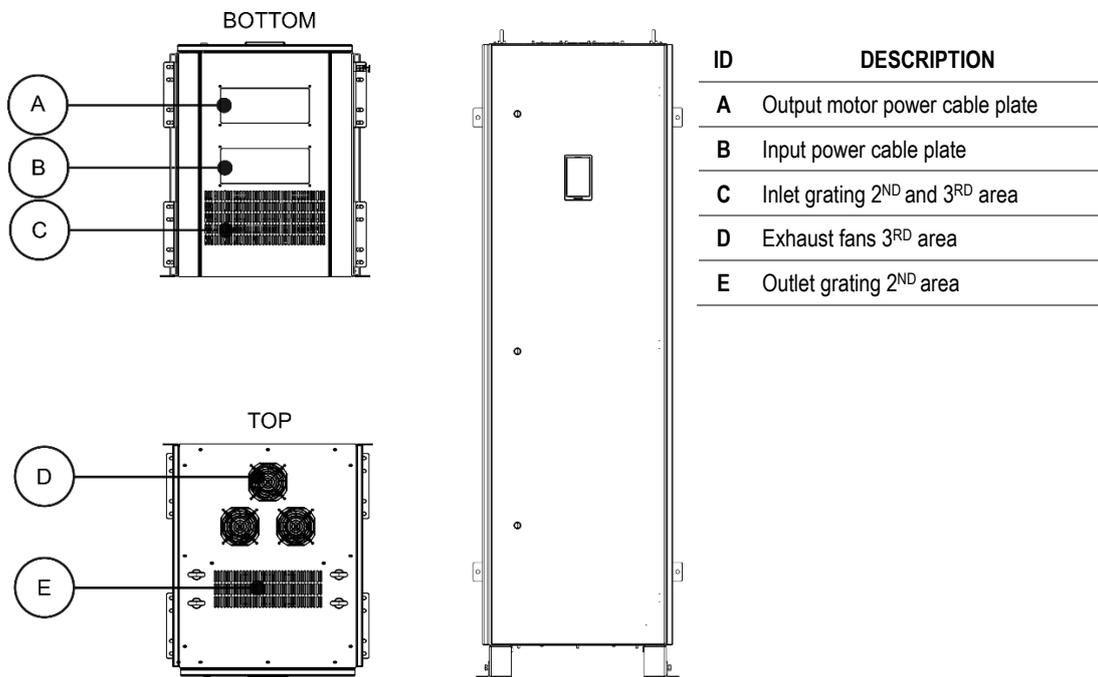
2nd Area/Level – Rectifier bridge, Inverter bridge and DC bus cooling area:

The drive integrates axial fans that intake the air from the bottom part of the drive and evacuates it through the middle top outlet gratings. The fans propel the air through the heat sink evacuating the heat generated by the main components. The fans will increase or decrease the internal air speed depending on the IGBT's temperature.

3rd Area/Level – Filters:

Cabinets integrate in its rear part the input LCL. Both are equipped with exhaust fans on the top of the cabinet that evacuates the internal heat generated within the area. Additionally, internal disperse fans are placed to increase the cooling capacity.

The installer must ensure that the indoor installation area is equipped with a suitable cooling system that is in accordance the ambient conditions of the drive (exhaust air vents, inlet gratings, air conditioning system, etc). The following figure and table provide the data for a correct cooling system dimensioning.



SD75FRDTG002AI

		ID	FRAME 5
GENERAL	INLET GRATING NET SECTION (m ²)	C	0.026028
2 ND AREA	MAXIMUM OPERATION FLOW (m ³ /h)	C-E	1600 m ³ /h
	OUTLET GRATING NET SECTION (m ²)	E	0.017642
3 RD AREA	MAXIMUM FLOW (m ³ /h)	D	480 m ³ /h

SD750FR has a modular design. Frames 6 to 8 drives consist of frame 5 units parallel connection. Therefore, to calculate the cooling data for bigger frames multiply the data from the tables above by the following factors.

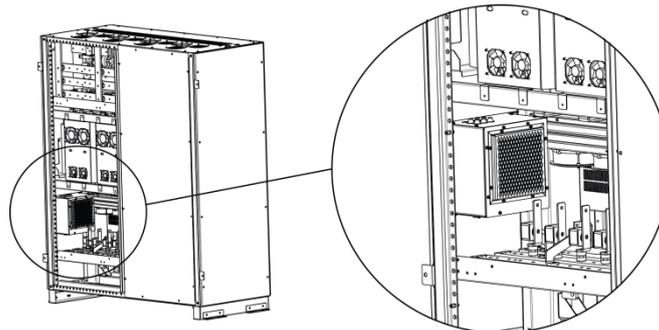
FRAME	6	7	8	9	10	11
FACTOR	x2	x3	x4	x6	x9	x12

Heat dissipation

The heat generated by the SD750FR depends on the carrier frequency (Hz), the grid frequency and the load. It can be estimated by the following equation, considering the worst case at rated power condition.

$$P_{\text{loss}} [\text{W}] = 0.03 \cdot P_{\text{motor}} [\text{W}]$$

In order to avoid dust ingress in the LCL contactor, the drive integrates in its bottom part a special box that contains it. The box's grating is protected with a dust filter that may be cleaned or replaced periodically depending on the ambient conditions. To clean or replace it, access from the rear part and remove the screws that fix the grating.



SD7FRITM0001A

7. POWER CONNECTION



CAUTION

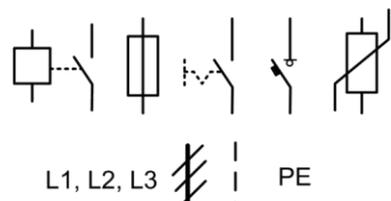
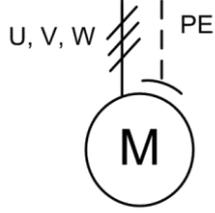
Please read the following instructions for proper electrical installation.
Otherwise, it could result in damage to equipment and personnel.

NOTICE

Consult the recommended tightening torque for both mechanical and electrical connections in section [“Torque and screw sizing”](#).

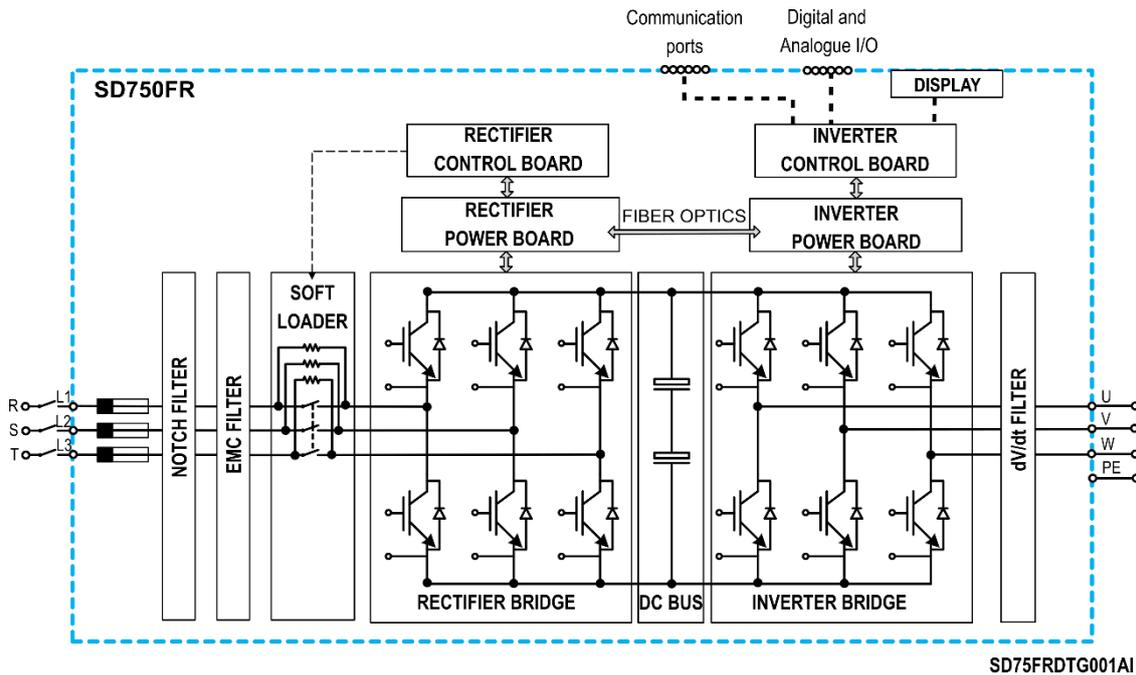
Basic configuration

Select the appropriate safety equipment and perform the wiring properly to ensure proper operation of the equipment. Incorrect application or installation can lead to malfunction of the drive and consequently reduce its life or damage its components. Read and understand this manual thoroughly before performing any operations.

	<p>AC Power Supply</p> <p>Use a power supply according to the selected drive. The SD750FR drives are available for TN, TT or IT grids (floating earth). Check the serial number to ensure the correct drive selection.</p>
	<p>External line-side protection</p> <p>Select fuses and switches in accordance with the recommendation within this manual and the applicable national and local regulations. Do not use them for the purpose of starting or stopping the drive. IT grids should be externally protected against insulation breakdowns and overvoltages.</p>
	<p>SD750FR Installation</p> <p>Install the drive following the recommendation within this manual in relation with the cooling requirements, position, clearances, wiring access and ground connection.</p>
	<p>Motor cables</p> <p>Select and install the motor cables according to the recommendation within this manual and the applicable national and local codes. An incorrect motor cable selection and installation could cause EMC filtering malfunction and motor damaged.</p>
<p>SD7FRITG0001A</p>	<p>Motor</p> <p>Do not connect capacitors for power factor protection, surge protectors or RFI filters at the drive output.</p>

Topology

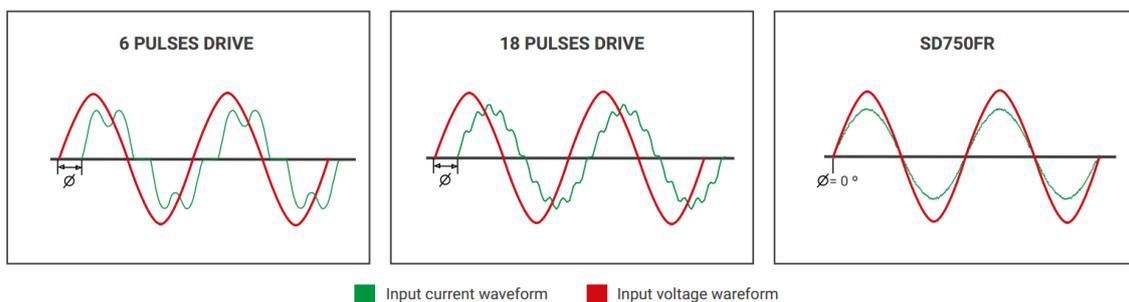
The following figure shows the upgraded power electronics for the SD750FR frame 5¹.



SD750FR is based on an active in feed topology that substitutes the thyristor diode rectifier by a controlled Isolated Gate Bipolar Transistor (IGBT) bridge. This bridge is operated by its own control and power board that creates an almost sinusoidal input current wave. This technology reduces the THDi with the highest efficiency and space savings. Furthermore, the $\text{Cos } \varphi = 1.0$ is adjustable and will be kept at any load condition. Forget the capacitor bank installation, additional bill charges and transformer and wiring overheating.

The active front end technology substitutes the multipulse drives and passive filters. The multipulse solutions have higher installation cost by means of special transformers and wiring requirements, no cosine phi control, filtering features load dependant, higher input voltage drops and no regeneration capacity.

The following charts show the input voltage and current waveforms differences between a 6-pulse drive, 18 pulse drive and SD750FR drive. It is shown the THDi reduction in the input current waveform for SD750FR drive.



¹ For frames 6 and over, the distribution is made up of several equipment frame 5 connected in parallel.

Power connection



CAUTION

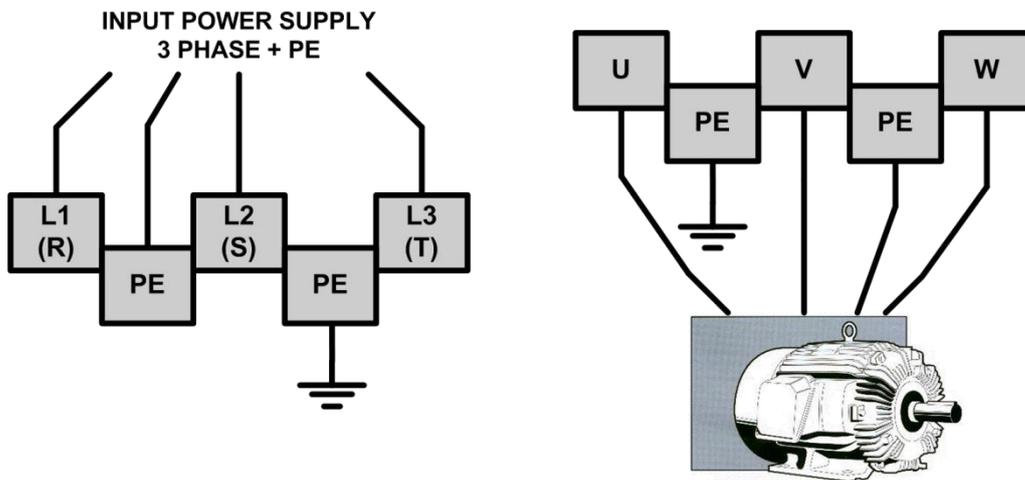
The following installation recommendations are suitable for TN and TT grids. For IT grids refer the dedicated section. Otherwise, you could cause damage to equipment and personnel.

Wiring and periodic inspections should be performed at least 10 minutes after disconnecting the input power. When removing the front cover, check that the red DC Link LED is off. Afterwards you can remove the metal cover and check with a multimeter the following measures:

- The voltage between the output plates U, V, W and the cabinet must be around 0V.
- The voltage between the DC link +, - terminals and the chassis must be below 30Vdc.

Otherwise, you may get an electric shock.

The input and output busbars are labelled according to the following diagram.



SD7FRDTP0002BI

The input terminals L1, L2, L3 and PE (drive power supply), output terminals U, V, W and PE (motor power supply) must be introduced through the metal plates situated in the bottom part of the cabinet.



NOTICE

To perform the fiber optic connections regarding the inverter part between modules, refer to the manual of the fiber optic board (SD75MA07).



CAUTION

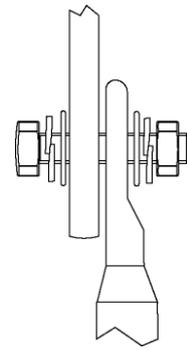
Do not drill or mechanize the gratings. Otherwise, the drive could reduce its cooling capacity.

Check that the power transformer of the 400Vac and 480Vac drives is correctly wired. Otherwise, the drive will not start.

The front metal panel corresponds to the motor cables and the rear metal panel to the input cables; these panels are not delivered neither drilled nor pre-marked to enable any configuration. Each cable must be equipped with its own cable gland or grommet that prevent dust or moisture from entering the equipment.

As standard, the input and output terminals are made of tin plated copper. If they are oxidized prior to its installation, the connections will be poorly executed and will cause overheating. To avoid this effect is recommended to follow the next steps.

- It is recommended to use Ø11 tin plated copper terminal lugs.
- Use M10 zinc bolts and nuts and apply a torque of 40Nm. Check after the first week of operation that the torque applied is maintained.
- The number of busbars depends on the frame size. Check the "[Power terminals](#)" section.
- Before connecting the cables, clean the contact surface with a clean cloth and ethanol cleaner.
- Use a pressure washer and a flat washer between the nut or bolt head and the terminal lug.
- Use copper or aluminium 600Vac conductors for up to 480Vac rated voltage. For 690Vac phase to phase rated equipment use 1kV conductors.

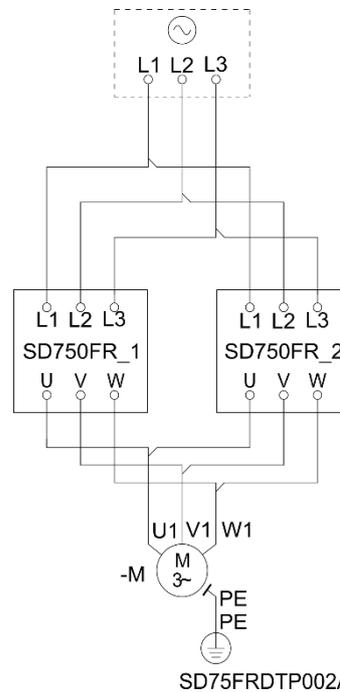


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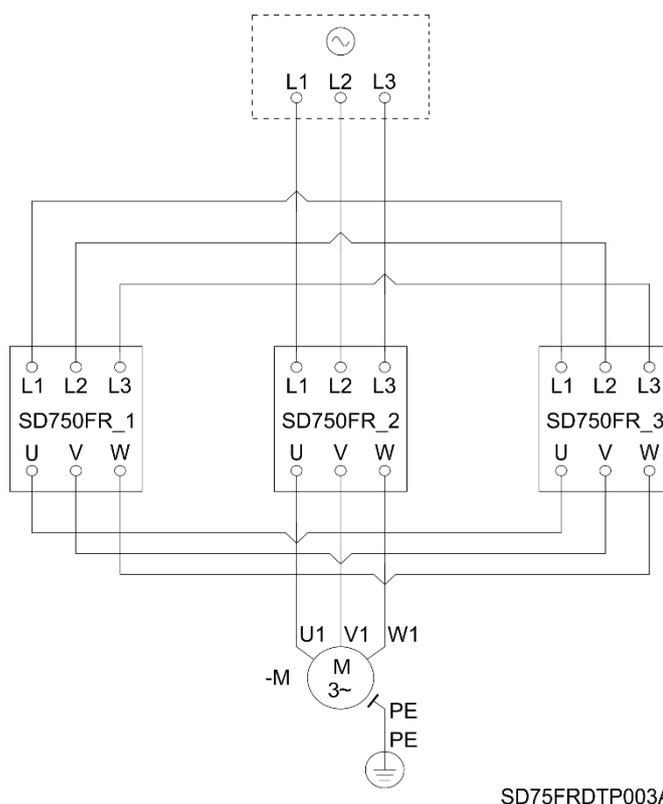
EN

Power connection for frames 9, 10 and 11

For frames 9 to 11, power connections must be made as shown in the following diagrams.



Power wiring connection for variable speed drives composed of two equipment of frame 9 to 11



Power wiring connection for variable speed drives composed of three equipment of frame 9 to 11

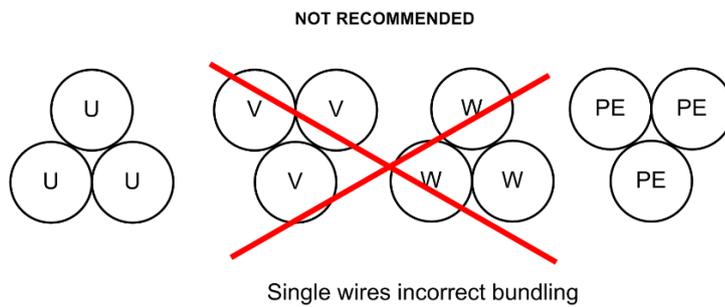
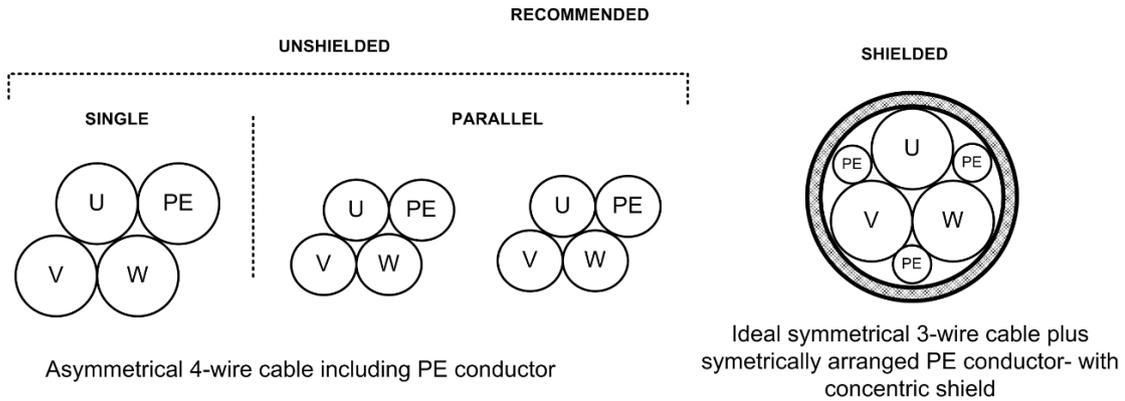
Wiring

The recommended cable types and lengths between the drive (with factory settings) and the motor are:

- **Unshielded cable:** 300m. Asymmetrical 4-wire cable including PE conductor. It is recommended to use a motor ground cable (PE) with a cross section equal or higher than the supply motor wires cross section (U, V, W). When single-wire cables are used in three-phase systems, the three phase conductors must be bundled symmetrically.
- **Shielded cable:** 150m. Symmetrical 3-wire cable with PE conductor- with concentric shield. To implement an effective shield bonding, an EMC cable gland should be used in both the motor junction box and the drive cabinet to ensure effective 360° ground connection and a low impedance path for high frequency current. Refer to "[EMC installation requirements](#)" section.

Wiring grouping

The following figures show the recommended cable type and bundling.

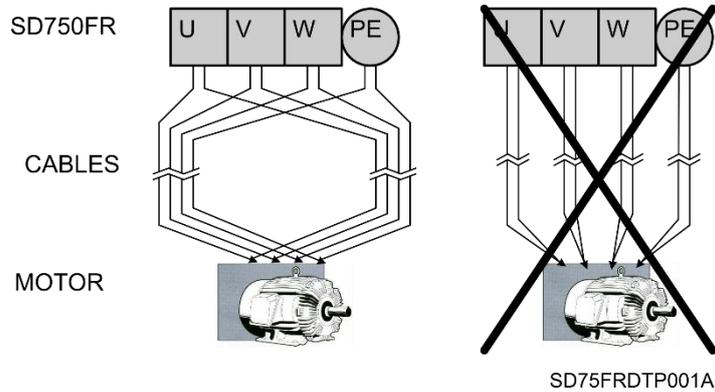


SD70DTP0006E1



NOTICE

The number of three phase plus neutral cable hose (U, V, W, PE) to the motor should be equal to the number of IGBTs in the drive, having one 4-wire cable hose by each IGBTs block.



CAUTION

Line voltage (input supply) must never be connected to U, V and W terminals. Otherwise, the drive may get be damaged.

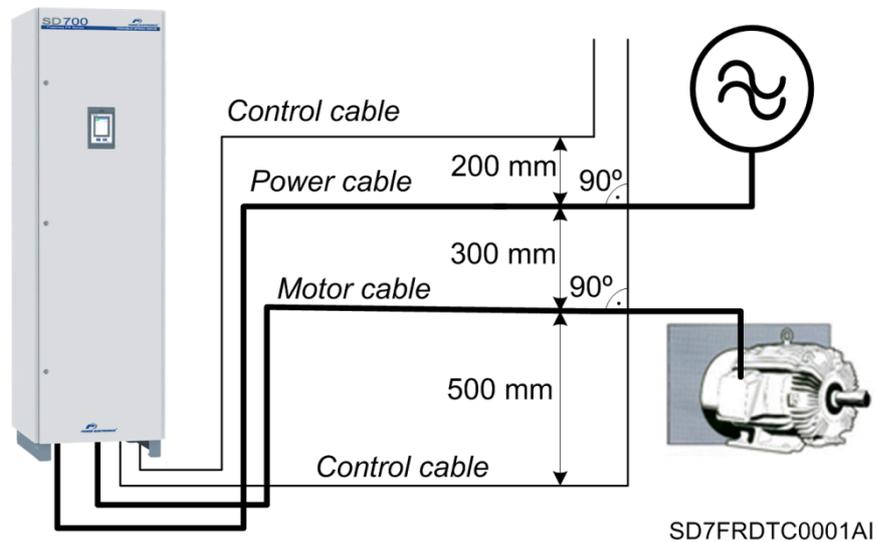
It is absolutely necessary that the installer ensures correct compliance with the laws and regulations in force in the countries or areas where the drive is to be installed.

Do not use capacitors for power factor correction, surge suppressors or RFI filters on the output side of the drive. Doing so may damage these components or the drive itself.

EN

Minimum distances between cables

All power conductors such as power input cables, output cables to the motor or DC link cables must be separated from the control, signal, PTC, encoder or data cables. The recommended distances between the cables are shown in the next figure:



Power Electronics recommends installing separately the following circuits, whether in cable racks, trays or in different wire ducts:

- Single-wire signal or data cables with $V < 60V$
- Single-wire cables with $60V < V < 230V$
- Input power cables with a low level of interferences $230V < V < 1000V$
- Output power cables to the motor and dynamic DC brake with a high level of interference $230V < V < 1000V$.
- Medium voltage cables with $V < 1000V$

Reference cable section

Power cables must have a sufficient nominal current to prevent important wiring overheating and voltage drops. It is only permitted the use of copper or aluminum cables. **Please check the maximum cable section and the available holes per phase in section “[Power terminals](#)”.**

The following tables show the **reference cable section** for each SD750FR frame, based on the internal drive sections. **The installer must consider the cable cross-section, cable type, wiring method and ambient conditions to select the appropriate cable to be installed between the drive and the motor.**

Note: The cable must permanently support a $T^a > 75^{\circ}\text{C}$. Use cable of 1000Vac (e.g. RV-K) for all equipment (400 to 690 Vac). **Make sure to comply with local regulations.**

The reference cable section for 9, 10 and 11 frames is defined as follows:

$$\text{modules} \times (\text{phases} \times (\text{active conductors per phase} \times \text{section}))$$

400Vac

FRAME	CODE	I(A) rated at 40°C	I (A) maximum at 40°C	Reference cable section (mm ²)	Reference cable section for ground cable (mm ²)
5	SD75F0260 5BCD	260	315	3x(1x185-240)	185-240
	SD75F0320 5BCD	320	375	3x(2x150)	2x150
	SD75F0340 5BCD	340	413	3x(2x185)	2x185
6	SD75F0400 5BCD	400	495	3x(2x185)	2x185
	SD75F0450 5BCD	450	555	3x(2x240)	2x240
	SD75F0570 5BCD	570	690	3x(2x240)	2x240
7	SD75F0700 5BCD	700	870	3x(2x240)	2x240
	SD75F0800 5BCD	800	975	3x(3x240)	3x240
	SD75F0900 5BCD	900	1080	3x(3x240)	3x240
8	SD75F1050 5BCD	1050	1260	3x(4x240)	4x240
	SD75F1140 5BCD	1140	1388	3x(4x240)	4x240
	SD75F1230 5BCD	1230	1485	3x(5x240)	5x240
9	SD75F1400 5BCD	1400	1725	3x(6x240)	6x240
	SD75F1550 5BCD	1550	1890	2x(3x(3x240))	3x(3x240)
10	SD75F1800 5BCD	1800	2160	2x(3x(4x240))	3x(4x240)
	SD75F1950 5BCD	1950	2370	2x(3x(4x240))	3x(4x240)
	SD75F2250 5BCD	2250	2700	3x(3x(3x240))	3x(3x240)
11	SD75F2750 5BCD	2750	3300	3x(3x(4x240))	3x(4x240)
	SD75F3100 5BCD	3100	3750	3x(3x(4x240))	3x(4x240)

440Vac

FRAME	CODE	I(A) rated at 40°C	I (A) maximum at 40°C	Reference cable section (mm ²)	Reference cable section for ground cable (mm ²)
5	SD75F0260 5BCD	236	286	3x(1x185-240)	185-240
	SD75F0320 5BCD	291	341	3x(2x150)	2x150
	SD75F0340 5BCD	309	375	3x(2x185)	2x185
6	SD75F0400 5BCD	364	450	3x(2x185)	2x185
	SD75F0450 5BCD	409	505	3x(2x240)	2x240
	SD75F0570 5BCD	518	627	3x(2x240)	2x240
7	SD75F0700 5BCD	636	791	3x(2x240)	2x240
	SD75F0800 5BCD	727	886	3x(3x240)	3x240
	SD75F0900 5BCD	818	982	3x(3x240)	3x240
8	SD75F1050 5BCD	955	1145	3x(4x240)	4x240
	SD75F1140 5BCD	1036	1262	3x(4x240)	4x240
	SD75F1230 5BCD	1118	1350	3x(5x240)	5x240
9	SD75F1400 5BCD	1273	1568	3x(6x240)	6x240
	SD75F1550 5BCD	1409	1718	2x(3x(3x240))	3x(3x240)
10	SD75F1800 5BCD	1636	1964	2x(3x(4x240))	3x(4x240)
	SD75F1950 5BCD	1773	2155	2x(3x(4x240))	3x(4x240)
	SD75F2250 5BCD	2045	2455	3x(3x(3x240))	3x(3x240)
11	SD75F2750 5BCD	2500	3000	3x(3x(4x240))	3x(4x240)
	SD75F3100 5BCD	2818	3409	3x(3x(4x240))	3x(4x240)

480Vac

FRAME	CODE	I(A) rated at 40°C	I (A) maximum at 40°C	Reference cable section (mm ²)	Reference cable section for ground cable (mm ²)
5	SD75F0260 5BCD	217	263	3x(1x185-240)	185-240
	SD75F0320 5BCD	267	313	3x(2x150)	2x150
	SD75F0340 5BCD	283	344	3x(2x185)	2x185
6	SD75F0400 5BCD	333	413	3x(2x185)	2x185
	SD75F0450 5BCD	375	463	3x(2x240)	2x240
	SD75F0570 5BCD	475	575	3x(2x240)	2x240
7	SD75F0700 5BCD	583	725	3x(2x240)	2x240
	SD75F0800 5BCD	667	813	3x(3x240)	3x240
	SD75F0900 5BCD	750	900	3x(3x240)	3x240
8	SD75F1050 5BCD	875	1050	3x(4x240)	4x240
	SD75F1140 5BCD	950	1157	3x(4x240)	4x240
	SD75F1230 5BCD	1025	1238	3x(5x240)	5x240
9	SD75F1400 5BCD	1167	1438	3x(6x240)	6x240
	SD75F1550 5BCD	1292	1575	2x(3x(3x240))	3x(3x240)
10	SD75F1800 5BCD	1500	1800	2x(3x(4x240))	3x(4x240)
	SD75F1950 5BCD	1625	1975	2x(3x(4x240))	3x(4x240)
	SD75F2250 5BCD	1875	2250	3x(3x(3x240))	3x(3x240)
11	SD75F2750 5BCD	2292	2750	3x(3x(4x240))	3x(4x240)
	SD75F3100 5BCD	2583	3125	3x(3x(4x240))	3x(4x240)

690Vac

FRAME	CODE	I(A) rated at 40°C	I (A) maximum at 40°C	Reference cable section (mm ²)	Reference cable section for ground cable (mm ²)
5	SD75F0160 6BCD	160	195	3x(1x70-120)	170-120
	SD75F0180 6BCD	180	225	3x(1x70-120)	70-120
	SD75F0210 6BCD	210	255	3x(1x95-150)	95-150
6	SD75F0250 6BCD	250	315	3x(1x120-240)	120-240
	SD75F0310 6BCD	310	390	3x(2x150)	2x150
	SD75F0400 6BCD	400	480	3x(2x185)	2x185
7	SD75F0480 6BCD	480	578	3x(2x240)	2x240
	SD75F0570 6BCD	570	690	3x(2x240)	2x240
8	SD75F0680 6BCD	680	825	3x(2x240)	2x240
	SD75F0825 6BCD	825	990	3x(3x240)	3x240
9	SD75F0930 6BCD	930	1125	2x(3x(2x240))	3x(2x240)
	SD75F1050 6BCD	1050	1260	2x(3x(2x240))	3x(2x240)
10	SD75F1200 6BCD	1200	1425	2x(3x(2x240))	3x(2x240)
	SD75F1400 6BCD	1400	1710	2x(3x(3x240))	3x(3x240)
	SD75F1550 6BCD	1550	1905	3x(3x(2x240))	3x(2x240)
	SD75F1750 6BCD	1750	2130	3x(3x(2x240))	3x(2x240)
11	SD75F1850 6BCD	1850	2250	3x(3x(2x240))	3x(2x240)
	SD75F2200 6BCD	2200	2700	3x(3x(3x240))	3x(3x240)

EN

Ground connection

Before connecting the power conductors, make sure that the chassis of the drive and the adjoining cabinets are connected to ground through the dedicated (PE) terminals. These are situated at both sides of the bottom metal walls of the drive and they are labeled with the earth symbol. Check section "[Power Terminals](#)".

The motor chassis ground must be connected to the drive. In other words, connect the motor's ground conductor to the PE protection terminal of the drive and not to the installation's ground. It is recommended that the section of the motor ground conductor (PE) has at least the same cross section as the motor power cables sections (U, V, W). Additionally, it must be installed following the recommendations indicated in sections "[Power connection](#)" and "[Wiring](#)".

The line ground must be connected to the drive. In other words, connect the installation's transformer ground conductor to the PE terminal of the drive and not to the installation's ground. We recommend that the cross section of the transformer's ground conductor (PE) complies with the IEC 61800-5-1 standard (10mm² for copper cables and 16mm² for aluminium cables). Additionally, it should be installed following the recommendations indicated in sections "[Power connection](#)" and "[Wiring](#)".

When connecting the earth, ensure that all connected cable terminals are properly tight and protected from mechanical forces. The tightening torque in case of M10 PE terminals is 40Nm.



CAUTION

For safety reasons, the earth resistance of the installation must be measured. This must be established before the first start up of the plant and with the drive disconnected.

It is the responsibility of the installer to provide the appropriate number, type and section of cables for the ground conductor in accordance with the characteristics of the equipment used and the plant to minimize ground resistance, which must comply with local and national regulations.

EMC installation requirements

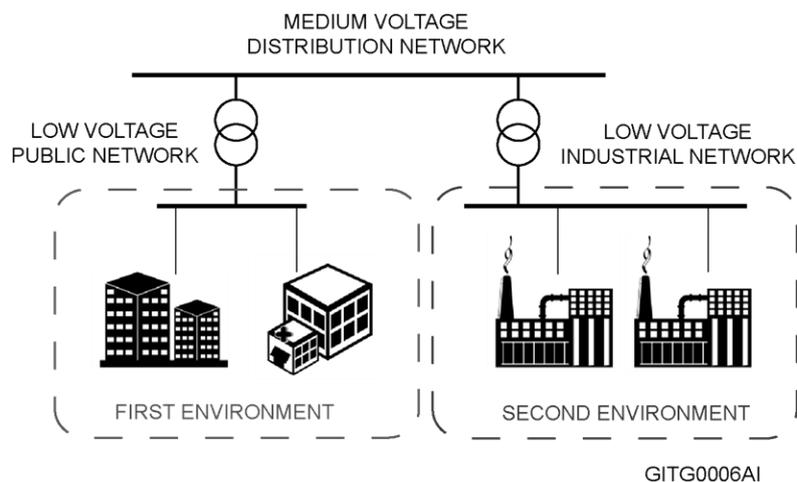
Introduction

The EMC European Directive defines electromagnetic compatibility as the capability of an apparatus, an industrial plant, or a system to work satisfactorily in the electromagnetic environment without at the same time causing electromagnetic disturbances in the apparatus, industrial plant or systems present in the same environment.

The Electromagnetic Compatibility (EMC) depends on two main characteristics of the equipment: Electromagnetic Interference (EMI) and Electromagnetic Susceptibility (EMS). The EMC standards aims to ensure that all the electrical equipment that could operate simultaneously in the same environment are compatible. This means that the interference immunity of all the devices is greater than the interference emission of all the devices within the same environment.

The EMC requirements for Power Drive System (PDS) are defined in IEC/EN 61800-3 standard that is included in the Declaration of conformity CE enclosed. In the European Union, EN61800-3 standard takes priority over all generic standards. The PDS in the context of this standard comprises the drive converter, the motor cables and the motor. Therefore, the installer as the ultimate responsible must follow the installation instructions given within this manual.

Depending on the location of the drive, the standards define four categories distributed in two environments.



- *First Environment:* Domestic installations. It also includes premises directly connected to a low-voltage power supply network without an intermediate transformer which supplies buildings used for domestic purposes such as shopping malls, cinemas, hospitals...
- *Second environment:* Industrial installations. Second Environment includes all plants other than those directly connected to the public low-voltage network which supplies buildings used for domestic purposes, e.g. factories and those other premises supplied by their own dedicated transformer.

The two environments are divided in four categories C1 to C4 that are summarized in the following table.

	FIRST ENVIRONMENT		SECOND ENVIRONMENT	
	C1	C2	C3	C4
Restricted Installation ^[1]	NO	YES	YES	YES ^[2]

Notes

[1] "Restricted Installation" means that the installation and commissioning must be carried out by specialist personnel.

[2] C4 Category applies only for complex systems or when ratings are equal or above to 1000 V or 400 A which are unable to comply with the limits of C3 Category. In these cases, C4 Category can be achieved by adjusting the equipment in situ and applying the EMC recommendations.

SD750FR compliance

SD750FR variable speed drives have been designed for the industrial use (Second Environment). The implementation of radio frequency interference filters (RFI filters) and dV/dt filters as standard, and the correct installation following the recommendations within this manual, permit to achieve compliance with C3 category defined in IEC/EN 61800-3.

Optionally, the SD750FR drive with non-floating earth can be installed in residential areas (First Environment) by employing optional RFI filters that permit to achieve the C2 category.

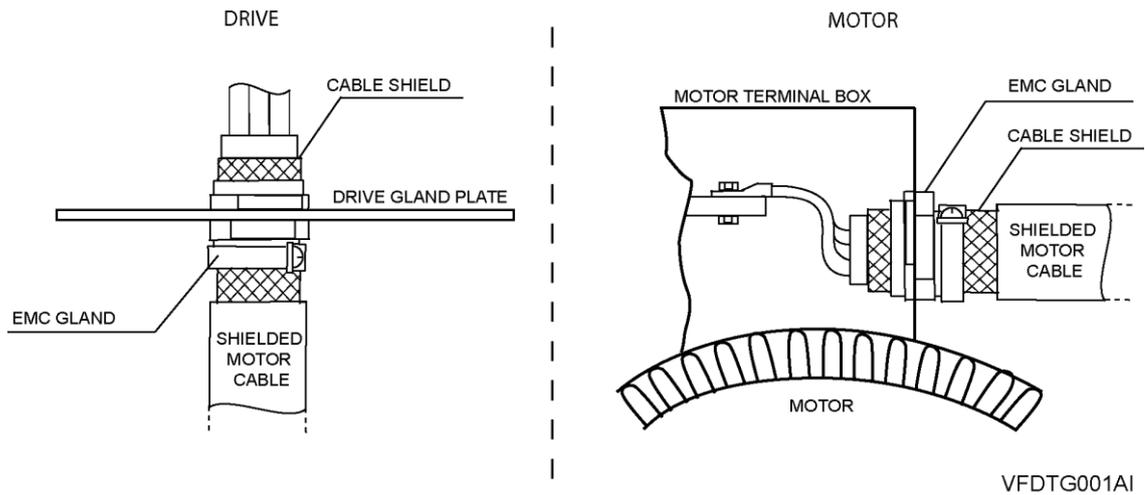
The SD750FR is not a retail unit. It is neither a plug in device nor a movable device and it is intended to be installed and commissioned by qualified personnel. Therefore, C1 category will not be required.

The SD750FR with floating earth configuration can be installed in industrial (Second Environment) IT grids. Although it does not integrate RFI filters, following the installation recommendations within this manual and with its integrated dV/dt filter, it achieves the C3 category defined in IEC/EN61800-3.

Connection

The SD750FR do not require the use of shielded motor cable to achieve compliance with C3 category when a correct installation is made. Wiring and Installation recommendations are included in sections "[Power connection](#)" and "[Wiring](#)" and "[Ground connection](#)".

In shielded cables it is recommended to connect the shield by making 360° contact in both the drive cabinet and the motor terminal box. As an example, EMC cable glands can be installed as shown in the next figure.



It is recommended to use shielded cable for control signals and to follow recommendations included in section "[Wiring recommendations](#)".



CAUTION

Select communication and control system according to the drive EMC environment. Otherwise, systems could suffer from interferences due to a low EMS level.

Protections

Short circuit

The SD750FR includes from frame 5 to 11 ultra-fast input protection fuses as standard. Frame 5 includes one fuse per phase with a rated current that depends on the drive's nominal current. From frame 6 upwards, the fuses per phase depend on the number of modules (frame 5) interconnected. The main characteristics of these fuses are shown in the following table.

FUSE CHARACTERISTICS

In (A)	Ic @ Un (A)	I ² t @ 1ms I ² t _p (A ² s)	I ² t @ Un (A ² s)	Un (V)	Manufacturer	Model
250A	200kA	4700	25000	690VAC	WESTCODE	069UR1S0250B
350A	200kA	10500	55000	690VAC	WESTCODE	069UR1S0350B

However, it is not recommended to install the drive at points where the short-circuit current available is higher than 200 kA. If necessary, install general fuses with a greater breaking capacity and with fastest overcurrent capacity.

FRAME	DRIVE	FUSES PER PHASE (N° X IN)	FRAME	DRIVE	FUSES PER PHASE (N° X IN)
400Vac – 480Vac			690 Vac		
5	SD75F0260 5BCD	1x350A	5	SD75F0160 6BCD	1x250A
	SD75F0320 5BCD	1x350A		SD75F0180 6BCD	1x250A
	SD75F0340 5BCD	1x350A		SD75F0210 6BCD	1x250A
6	SD75F0400 5BCD	2x350A	6	SD75F0250 6BCD	2x250A
	SD75F0450 5BCD	2x350A		SD75F0310 6BCD	2x250A
	SD75F0570 5BCD	2x350A		SD75F0400 6BCD	2x250A
7	SD75F0700 5BCD	3x350A	7	SD75F0480 6BCD	3x250A
	SD75F0800 5BCD	3x350A		SD75F0570 6BCD	3x250A
	SD75F0900 5BCD	3x350A	8	SD75F0680 6BCD	4x250A
SD75F1050 5BCD	4x350A	SD75F0825 6BCD		4x250A	
8	SD75F1140 5BCD	4x350A	9	SD75F0930 6BCD	6x250A
	SD75F1230 5BCD	4x350A		SD75F1050 6BCD	6x250A
9	SD75F1400 5BCD	6x350A	10	SD75F1200 6BCD	6x250A
	SD75F1550 5BCD	6x350A		SD75F1400 6BCD	9x250A
10	SD75F1800 5BCD	8x350A	10	SD75F1550 6BCD	8x250A
	SD75F1950 5BCD	8x350A		SD75F1750 6BCD	8x250A
	SD75F2250 5BCD	9x350A	11	SD75F1850 6BCD	6x250A
SD75F2750 5BCD	12x350A	SD75F2200 6BCD		12x250A	
11	SD75F3100 5BCD	12x350A			

Ground fault protection

The drive is equipped with an internal software that protect the motor and the drive against input and output unbalanced currents. The response threshold can be set from 0% to 30% of the rated current. For further information, see *Programming and Software Manual*.

This function is not intended to protect people against direct or indirect contacts or against fire, so an external protection must be provided to ensure that a substantial ground fault current is promptly interrupted. The SD750FR drives are suitable to operate with RCD components Type B, if it is required. The EMC / EMC filters and motor cable lengths increase the earth leakage currents, so the protection range is set according to the installation conditions. For additional information, contact Power Electronics.

Motor thermal protection

The drive includes a motor thermal protection based on the motor performance parameters which mathematically calculates the remaining heating capacity in the motor. When this reservoir is reduced below the limits, this is, the motor temperature approaches the maximum, the drive automatically stops the motor. For further information consult the *Software and Programming Manual*.

The drive includes as standard a PTC connection that permits monitor the motor temperature. Once connected and configured, the drive could either stop the motor or generate a warning signal.

Low Voltage Ride Through (LVRT)

The Low Voltage Ride Through (LVRT) protection is very useful for applications that control a continuous process and cannot afford to stop because of short voltage outages or dips coming from the grid. The process must continue to run through these outages, typically 2 to 3 cycles.

Voltage dips cause a decrease of the DC Bus voltage in the drive. During very brief dips, it may be possible to supply the energy from the DC Bus capacitors. However, during longer dip periods, the DC Bus voltage will drop to a lower level and if this falls below the DC Bus trip voltage, the drive will trip in the default configuration.

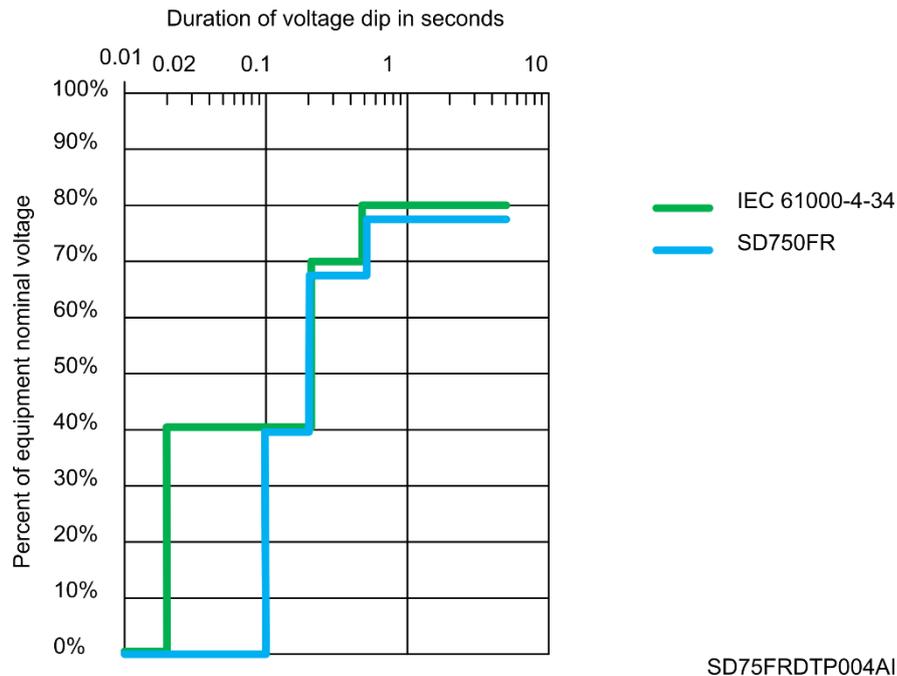
A voltage dip could usually be a risky situation for any kind of equipment and / or circuit protection devices connected to the grid when it is cleared. At this moment, as full AC voltage is connected, some devices, including VFD's, can demand a high current causing high voltages and current transients.

SD750FR drives are by default in compliance with IEC/EN 61800-3 product standard "Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods". Dip test levels are defined in IEC 61000-4-34 "Voltage dips, short interruptions and voltage variations immunity tests for equipment". During a voltage dip, drives are allowed, by criterion C of IEC/EN 61800-3, to trip. A manual restart could even be required. They are neither allowed to be damaged nor misconfigured.

Furthermore, SD750FR drives with software version AFE_R1.4.0 or higher, include a new algorithm that overperforms the requirements of the standard by making them comply with the criterion A or B of the IEC/EN 61800-3, for the tests as defined in IEC 61000-4-34, regardless of the voltage dip depth and duration, and capable to restart them automatically without affecting its operational safety during a voltage dip. Depending on the voltage dip depth and duration, the drive's two possible behaviours are as follows:

- When voltage dips are up to 70%, the drive remains connected, regulating the DC voltage and keeping the motor's performance at any moment.
- When voltage dips are higher than 70%, the drive remains connected using the rectifier bridge in "diodes" mode (no IGBT switching) and the DC Bus voltage varies depending on the input voltage level. In this case, the motor can increase its input current, and vary its torque and speed response depending on its operation conditions. When the input voltage is back to nominal conditions, the rectifier bridge restarts automatically and the intended torque and motor speed levels are recovered immediately.

Test results can demonstrate that SD750FR new LVRT algorithm improves the requirements of the standard, not only on performance criteria achieved, but also in dips severity, as shown in the next figure:



Other protections

Apart from the protections mentioned above, the drive implements additional protections such as temporary loss of power, automatic re-start, high and low input and output voltage, overload or underload of the pump, etc. For further information, consult the *Software and Programming Manual*.

Safety Stop Function

The Safety Stop Function allows the drive's output to be disabled so that the drive cannot provide power or generate torque in the motor.

The Safe Torque Off function complies with EN ISO 13849-1 PLd. This feature is standard and allows you to comply with current safety standards. For more information see section "[STO - Safe Torque Off](#)".

IT Grids - Floating earth drives

When planning an IT grid electrical installation select the drive for floating earth operation. Check the drive reference and make sure that the drive is suitable for this type of installations.

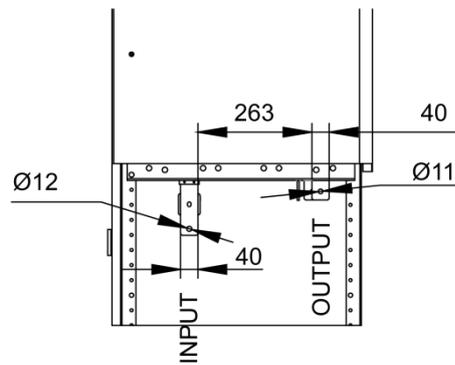
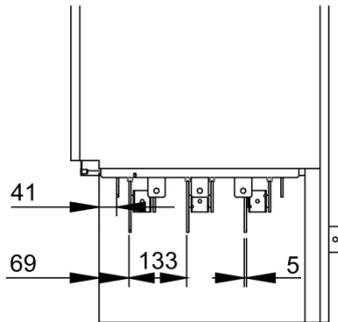
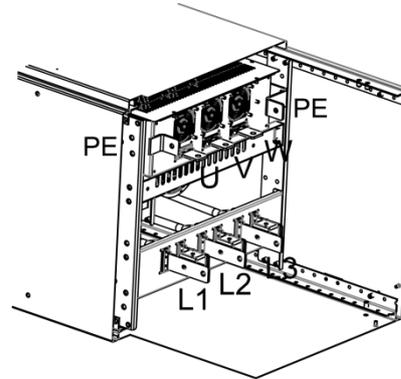
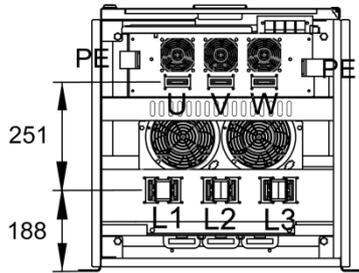
IT grids must be equipped with an insulation monitoring system. To adjust the parameters, consider that the drive has a very high impedance even if there is a large number of equipment working in parallel in the same IT network.

It is recommended the installation of lightning rods to ground in order to protect against transient overvoltages. The lightning rod must have a rated voltage greater than the drive rated voltage for the purpose of preventing its operation during normal conditions.

Power terminals

The following figures show the location, in millimeters, of power terminals for each frame of SD750FR.

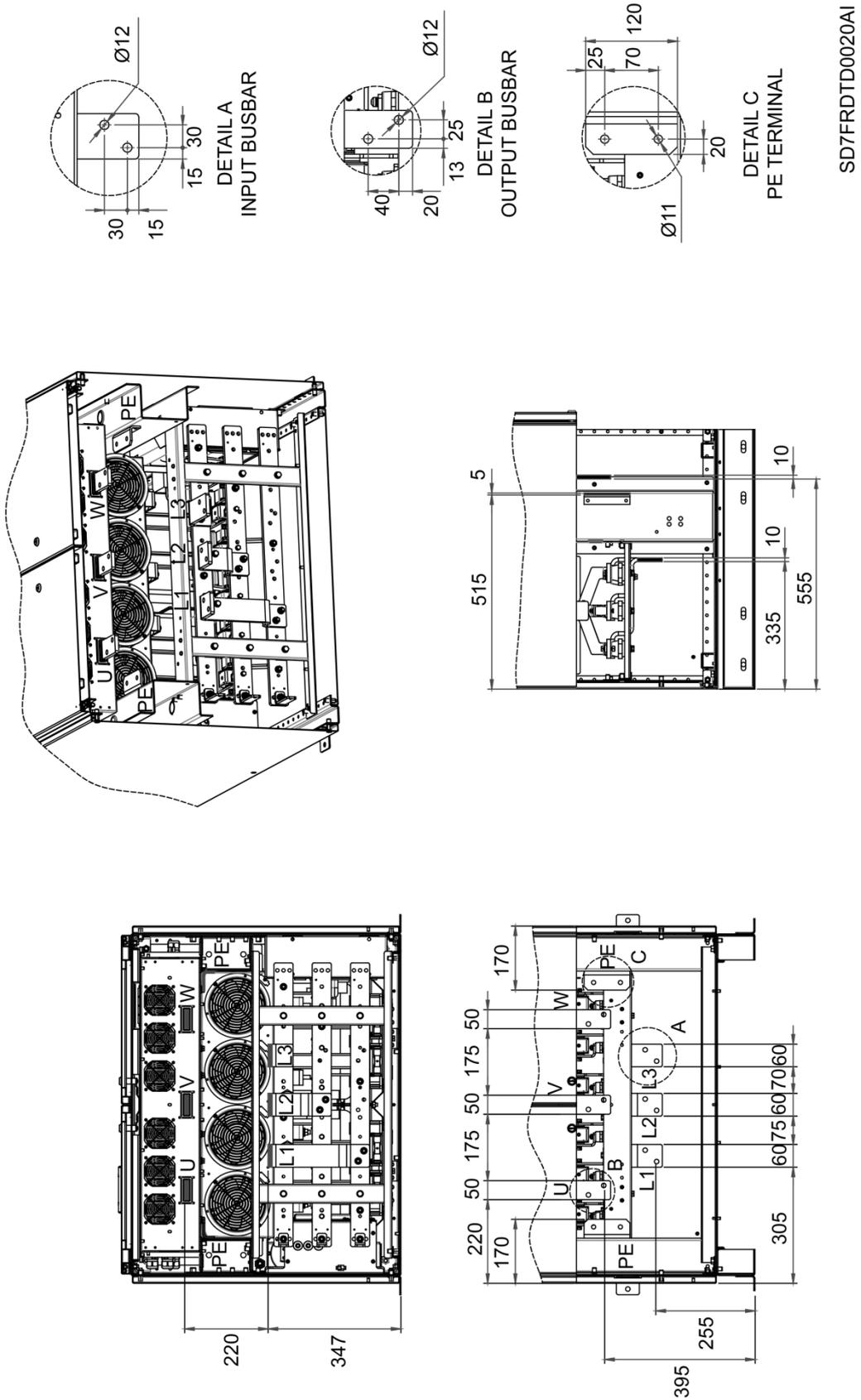
Connections for frame 5



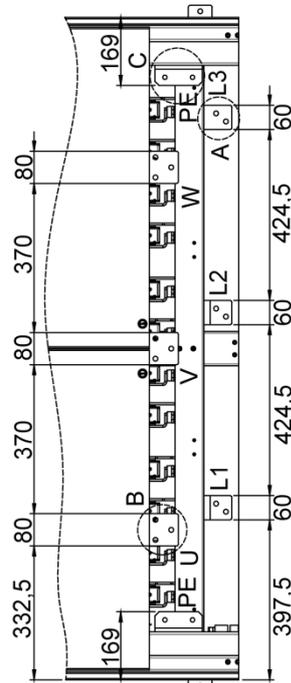
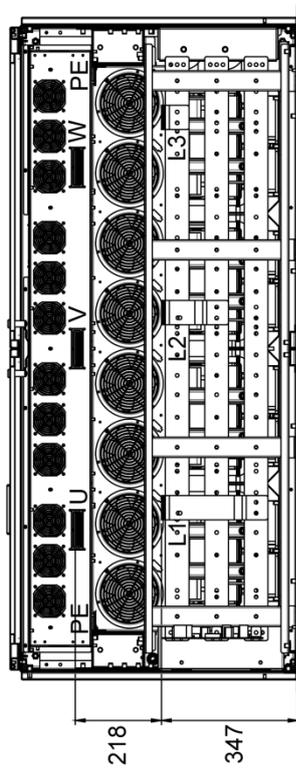
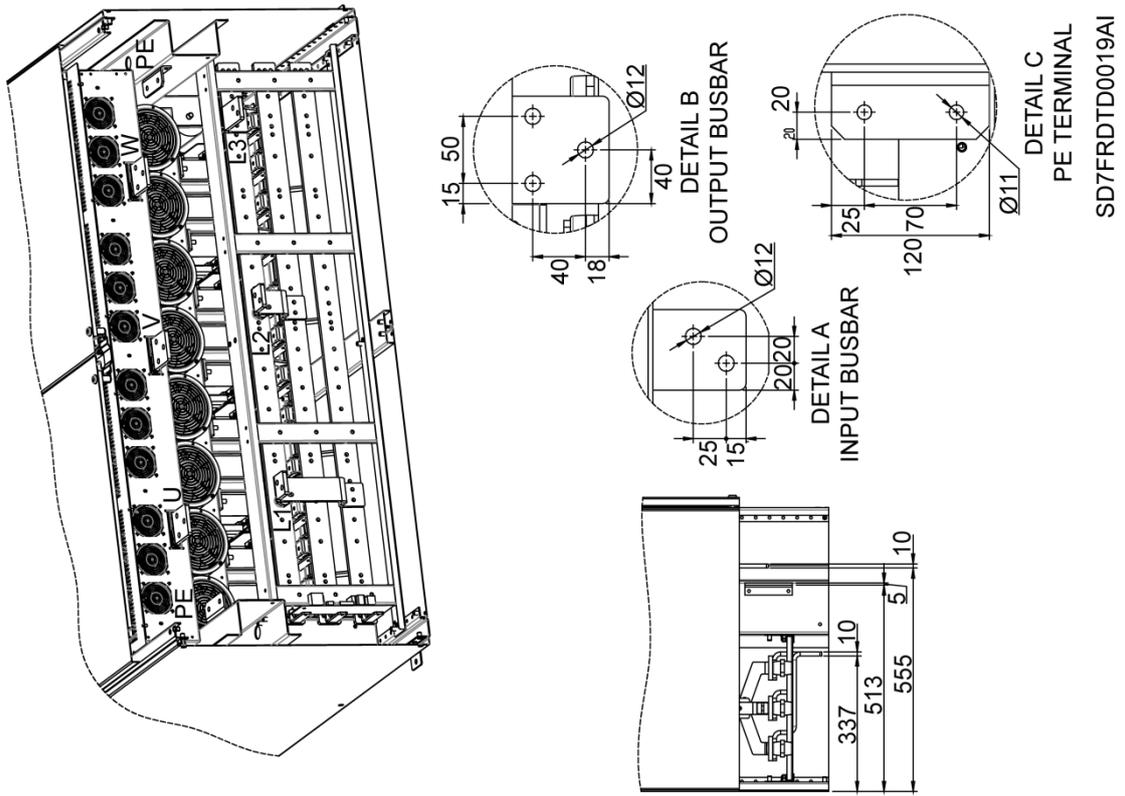
SD7FRDTD0017AI

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Connections for frame 6



Connections for frame 8



Connections for frame 9, 10 and 11

For the location of the connection plates consult the connection diagrams of frames 6, 7 and 8 as appropriate.

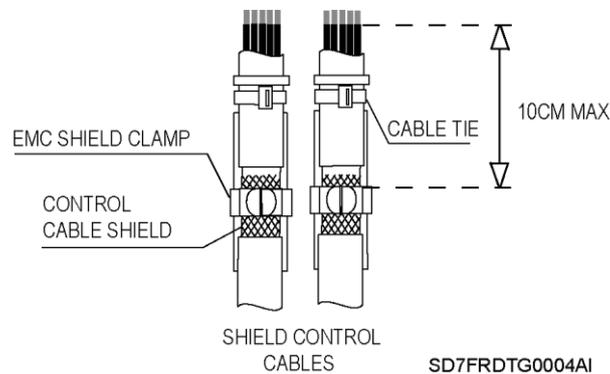
8.CONTROL CONNECTION

8

Wiring recommendations

Before planning the installation, follow and understand the next recommendations. The parallel cable routing should be avoided and the distance between the control wiring and the power wiring should be maximized. It is recommended to route control cables with different voltages in separately cable racks, trays or ducts.

It is recommended to use shielded cable for all the data, signal or control cables coming from the variable speed drive. Each cable must have an EMC clip that secures an effective ground shield, making a contact of the 360° shield.



Cable shields for digital signal must be grounded at both ends of the cable. It is recommended to use independent shielded cables for digital and analogue signals. When using multiple analogue signals, do not use common return for them. If using analogue signals, a low interference is experienced (hum loops), disconnect the shield grounding from one of the ends. The maximum section for the control cables is 2.5mm² and the recommended tightening torque is 0.4Nm.

Although the control boards are insulated galvanically, for safety reasons it is recommended not to modify the wiring while the equipment is connected to the input power supply.



CAUTION

Any change to the control board wiring or bridges must be performed following the safety instructions indicated before. Otherwise, it could cause damage to the equipment and cause damage to people.

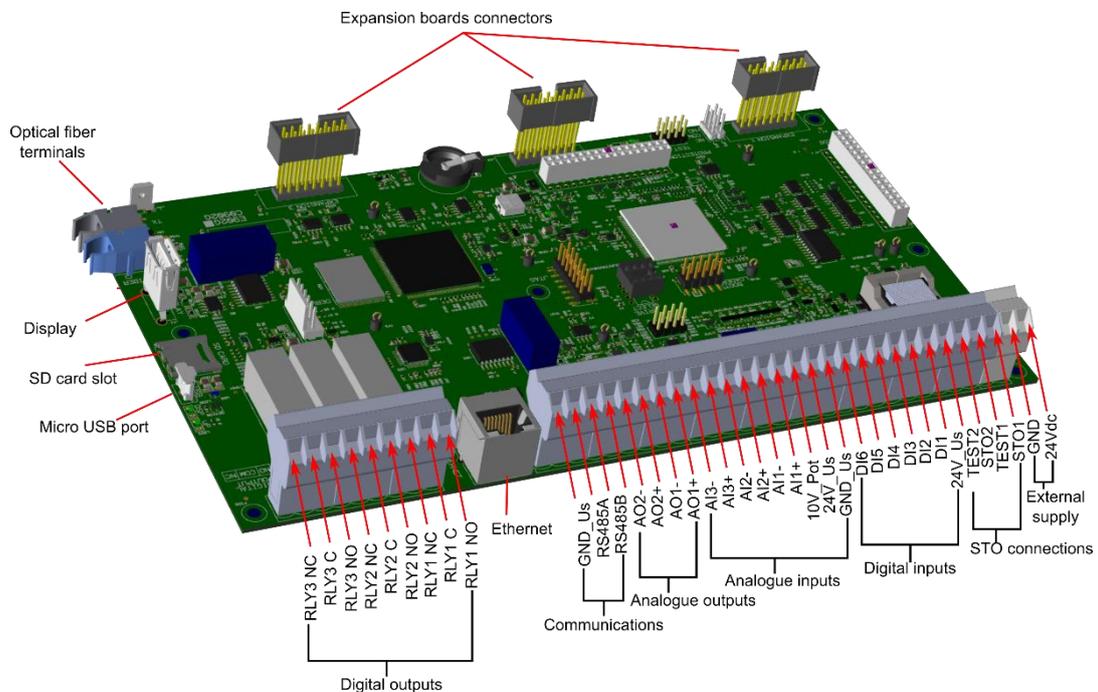
Control board terminals description



CAUTION

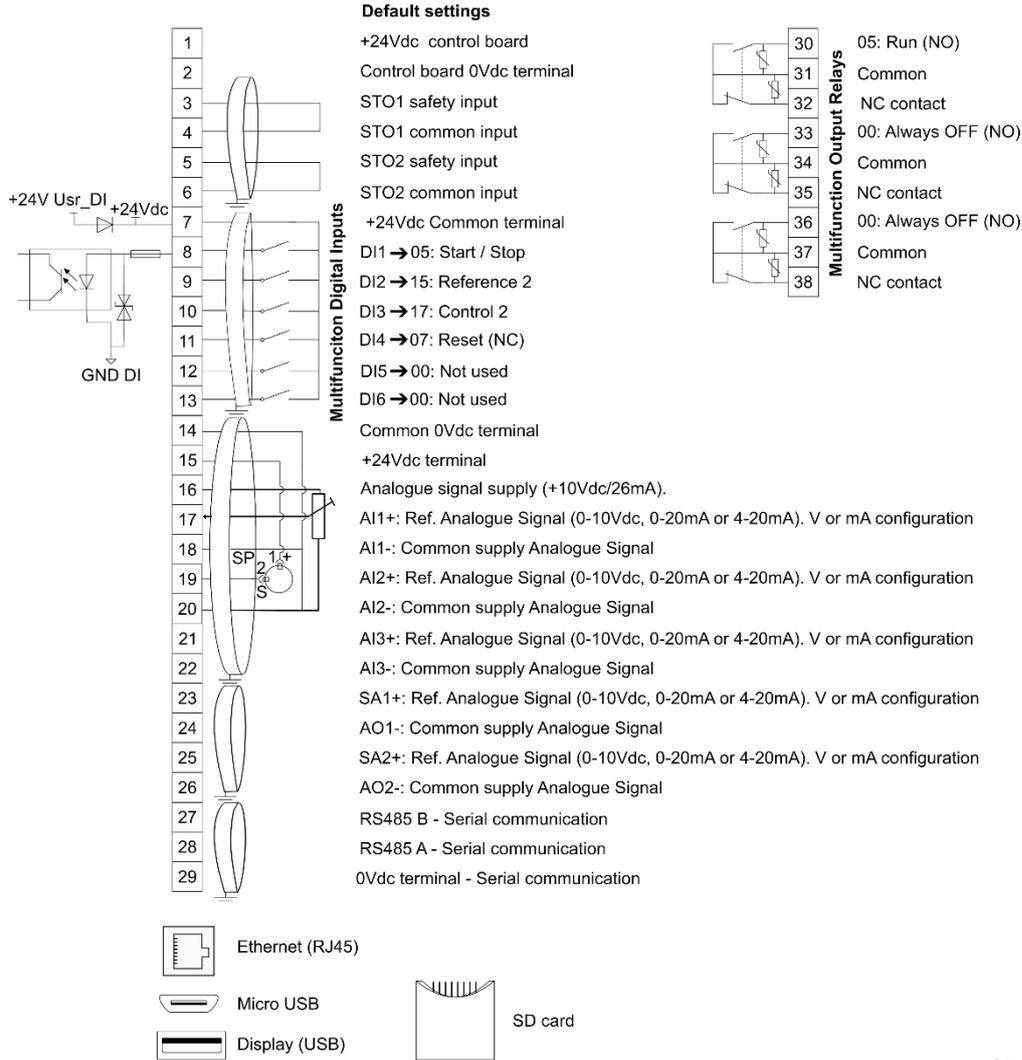
Any changes to the control board wiring or bridges must be performed at least 10 minutes after disconnecting the input power and after checking the bus voltage (DC Link) is discharged below 30VDC. Otherwise, you may get an electric shock.

User will have access to the drive control board equipped with user interface ports and connectors. It integrates PTC connection, analogue inputs and outputs, digital inputs and outputs, DC external input power supply, RS485 communication ports, Ethernet, USB port and display connection. In addition, the board is ready for the connection of optional boards such as I/O expansion board, encoder board, communication boards, fiber optic board, etc.



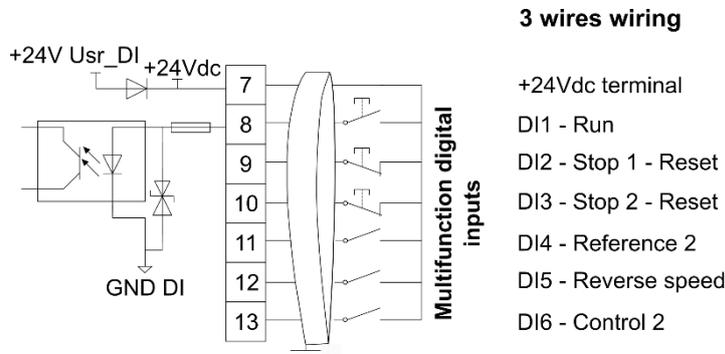
SD75ITC002DI

The following figure provides a standard wiring overview of the control terminals.



SD75DTC0002EI

Digital inputs can be configured individually or collectively. Analogue inputs can be configured as comparators. For further information on configurations, please refer to the *Software and Programming Manual*. The following figure shows the wiring detail of the X1 connector with the wiring of the three-wire start / stop buttons.



SD75DTC0003BI



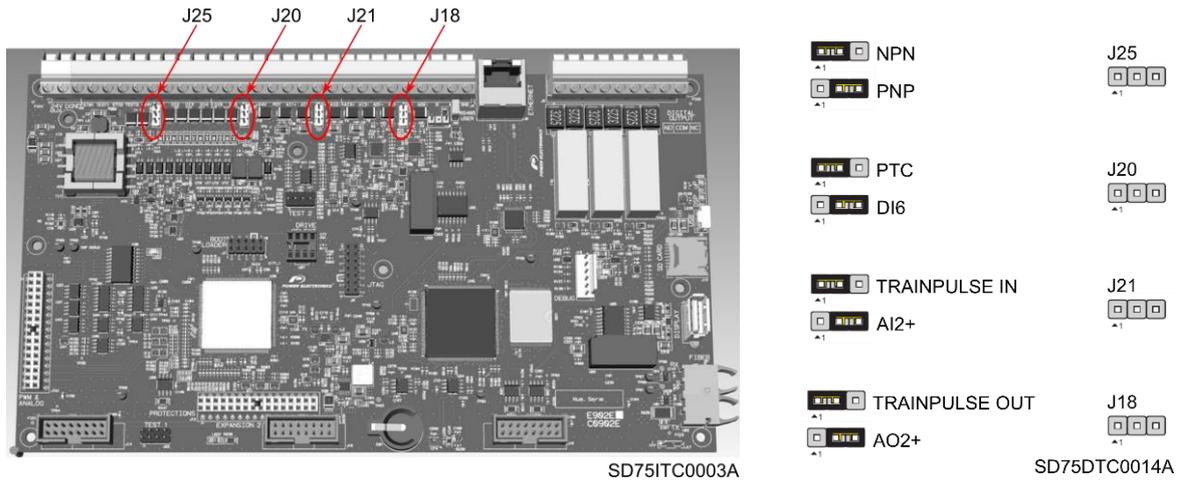
	PIN	SEÑAL	DESCRIPCIÓN
EXT. SUPPL	1	+24Vdc	Power supply 24Vdc control card.
	2	GND	GND control board.
STO FUNCION	3	STO 1[1]	Safety input STO 1.
	4	TEST 1	Safety common input STO 1.
	5	STO 2[1]	Safety input STO 2.
	6	TEST 2	Safety common input STO 2.
DIGITAL INPUTS	7	+24V_USER	Power supply for digital inputs. Protect against short circuit and overload. (Maximum +24Vdc, 180mA).
	8	DI1	Programmable Digital Input 1 (Digital Input 1). Digital inputs are configured in the Input group. Their status can be displayed in the visualization group. It is powered from terminal 7 or from an external power 24Vdc supply. If an external power supply is used, the common must be connected to terminal 29 (GND_USER). Programmable input as PNP and NPN [2].
	9	DI2	Programmable Digital Input 2. Same features as DI1.
	10	DI3	Programmable Digital Input 3. Same features as DI1.
	11	DI4	Programmable Digital Input 4. Same features as DI1.
	12	DI5	Programmable Digital Input 5. Same features as DI1.
	13	DI6	Programmable Digital Input 6. Same features as DI1. Besides, input configurable as digital PTC.
ANALOGUE INPUTS	14	GND_USUARIO	GND connection (0 V) for inputs
	15	+24V_USUARIO	Supply voltage for analog inputs
	16	10V_POT	10V power supply for potentiometer. Ready to supply a maximum of 2 potentiometers ($R \geq 1k\Omega$).
	17	AI1+	Voltage or current Programmable Analogue Input 1 (V o mA). Configurable to 0-10Vdc, 0-20mA or 4-20mA [3]. The value of the input resistance in voltage mode is $R_i = 20k\Omega$. The value of the input resistance in current mode is $R_i = 250\Omega$.
	18	AI1-	Common Analog Input 1.
	19	AI2+-	Voltage or current Programmable Analogue Input 2 (V o mA). Configurable to 0-10Vdc, 0-20mA or 4-20mA. The value of the input resistance in voltage mode is $R_i = 20k\Omega$. The value of the input resistance in current mode is $R_i = 250\Omega$.
	20	AI2-	Common Analog Input 2.
	21	AI3+-	Voltage or current Programmable Analogue Input 3 (V o mA). Configurable to 0-10Vdc, 0-20mA or 4-20mA. The value of the input resistance in voltage mode is $R_i = 20k\Omega$. The value of the input resistance in current mode is $R_i = 250\Omega$.
ANALOGUE OUTPUTS	22	AI3-	Common Analog Input 3.
	23	AO1+	Voltage or current Programmable Analogue Output 1 (V o mA). Configurable to 0-10Vdc, 0-20mA or 4-20mA.
	24	AO1-	Common Analog Output 1.
	25	AO2+	Voltage or current Programmable Analogue Output 2 (V o mA). Configurable to 0-10Vdc, 0-20mA or 4-20mA.
COMMUNICATIONS	26	AO2-	Common Analog Output 2.
	27	RS485 B	RS485 Modbus serial communication interface.
	28	RS485 A	RS485 Modbus serial communication interface.
DIGITAL OUTPUTS	29	GND_USER	GND Connection.
	30	RLY1 NO	Digital Output 1. Programmable change over relay (NO / NC). Potential free (Maximum: 250VAC, 8A; 30VDC, 8A).
	31	RLY1 C	
	32	RLY1 NC	
	33	RLY2 NO	Digital Output 2. Programmable change over relay (NO / NC). Potential free (Maximum: 250VAC, 8A; 30VDC, 8A).
	34	RLY2 C	
	35	RLY2 NC	
	36	RLY3 NO	Digital Output 3. Programmable change over relay (NO / NC). Potential free (Maximum: 250VAC, 8A; 30VDC, 8A).
	37	RLY3 C	
	38	RLY3 NC	

^[1] It is recommended to use double shielded twisted-pair cable for 24Vdc power supply and safety channels. The shield must be grounded as shown in the examples.

^[2] When a PNP or NPN input is configured, the rest of digital inputs will have to be the same. This means, PNP and NPN inputs cannot coexist.

^[3] Analogue inputs and outputs are configured individually and through the use of Software. In case of configuring the AI3 in mode PT100, the analogue output (any of the two) must be configured in mode 10mA.

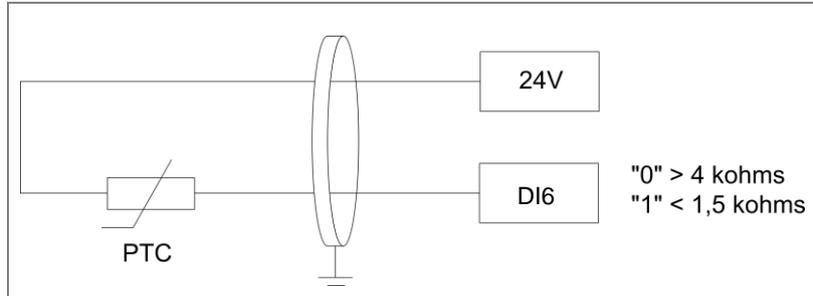
Up next, information about location and use of the jumpers associated to the control board are shown:



Jumper (Signal)	Description	Positions
J18 (AO2+)	Configures AO2+ as Analogue Output or Pulse Output.	
J20 (DI6)	Configures the AI6 as Digital Input or PTC.	
J21 (AI2+)	Configures the AI2+ as Analogue Input or Pulse Input.	
J25 (DI1 a DI6)	Configures each DIx as NPN or PNP.	

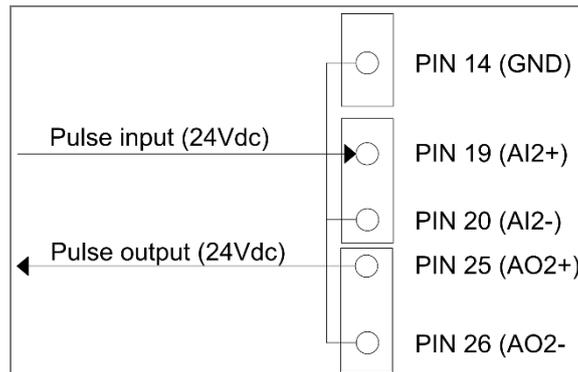
DI6 (PIN13) PTC sensor input mode.

It is possible to connect a PTC sensor in the digital input 6 (DI6) so that the equipment acts from a temperature (resistance) value associated to motor's temperature and to allow enabling cooling or stop motor running. It must be considered that sensor resistance does not exceed trigger point (pass from 1 to 0) of the DI6 when motor is under normal conditions of operation temperature. Cable ground screening must be connected only in one end.



AI2/AO2 (PIN19/25) pulse input/output mode.

Both analogue input and output 2 can be configured as pulse input/output. To do so, bridge J21 must be connected in the position indicated in the table above and, besides, they must be connected to GND (PIN 14).

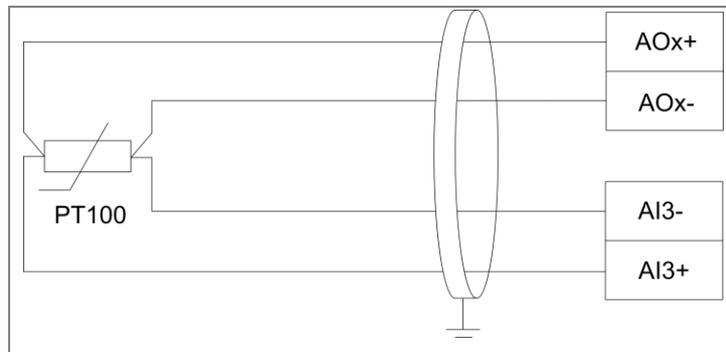


AI3 (PIN 21/22) PT100 mode.

The AI3 allows configuring a PT100 sensor. With this sensor, motor temperature can be measured continuously. Ground cable screening must be connected only in one end. For further information about parameter configuration, consult the *Software and Programming Manual*.

Measurement process:

- a. The chosen analogue output will be configured in current mode, 10 mA, through software. It is recommended to use analogue output 1.
- b. The analogue input 3 (AI3) will be configured in PT100 mode through software.
- c. A current of 1mA (generated by the analogue output) is injected through the PT100.
- d. Voltage in the analogue input is measured.
- e. With injected current and voltage, the PT100 resistance is calculated.
- f. With the PT100 table, and knowing the resistance, temperature is obtained.

**NOTICE**

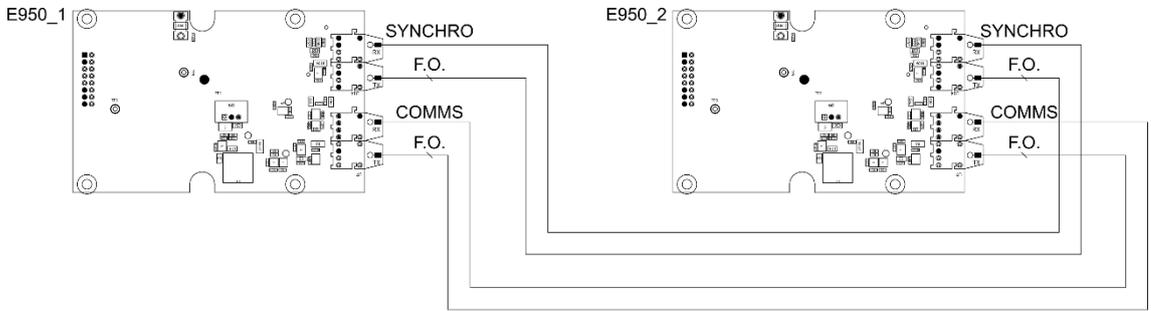
Terminals PIN14 and PIN15 can be used for other functions depending on the inverter bridge characteristics (frequency regulation by external potentiometer, analogue feedback, etc.). to avoid multiple connections in one terminal (PIN 14, PIN 15), it is advisable to add external terminals for supply distribution.

Fiber optic connections rectifier part

Connection between modules

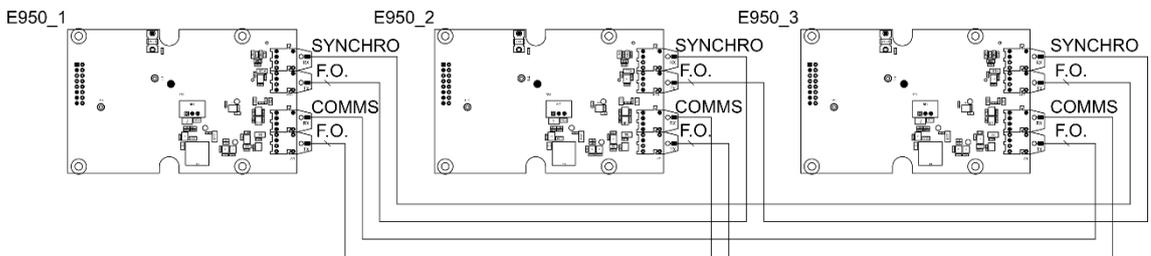
Follow the next electrical schemes to connect SD750FR variable speed drives with two or three modules.

Connection of 2 modules



SD75FRDTG003A

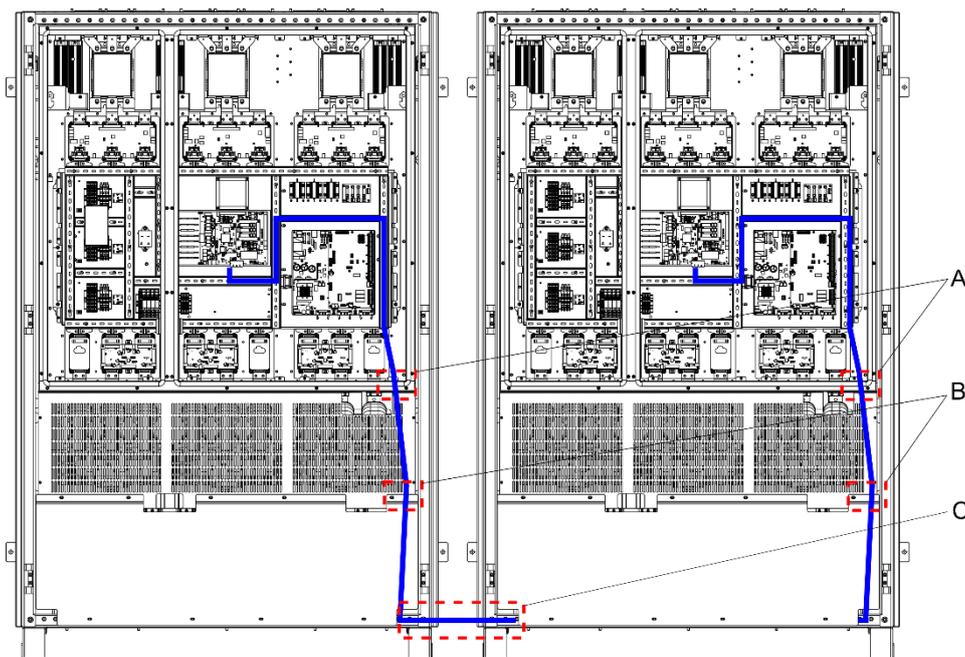
Connection of 3 modules



SD75FRDTG004A

Wire routing

The image below shows how wiring should be routed for connecting the different modules.



SD75FRDTG005A

POINTS OF REFERENCE	DESCRIPTION
A	Pass the cables through the bushing.
B	Pass the cables through the opening.
C	Pass the cable between the equipment.



NOTICE

To perform **the fiber optic connections regarding the inverter part between modules**, refer to the manual of the fiber optic board (SD75MA07).

STO - Safe Torque Off

The STO function is defined as: *Power, that can cause rotation, is not applied to the motor. The frequency converter will not provide energy to the motor, which can generate torque.*

For three-phase asynchronous motor, that means to stop three-phase power supply to the stator.

This function corresponds to a Category 0 Emergency Stop according to IEC 60204-1. When the drive is running and the STO function is applied, the motor will freely stop by its own inertia.

By using this function, the user can safely carry out cleaning, maintenance or emergency work on non-electric parts of the equipment, without having to disconnect the power supply. In case STO safety function is not used, user must connect the corresponding terminals.

Based on a study of each application and risk assessment, the designer should define the required safety function and safety level.



CAUTION

The STO safety function does not disconnect nor the main neither the auxiliary power supply. With STO function the drive disconnects the motor power supply. To carry out electrical maintenance tasks, isolate the drive. Particular care must be taken with the active conductors inside the drive. Failure to do so could result in damage to equipment and personnel.

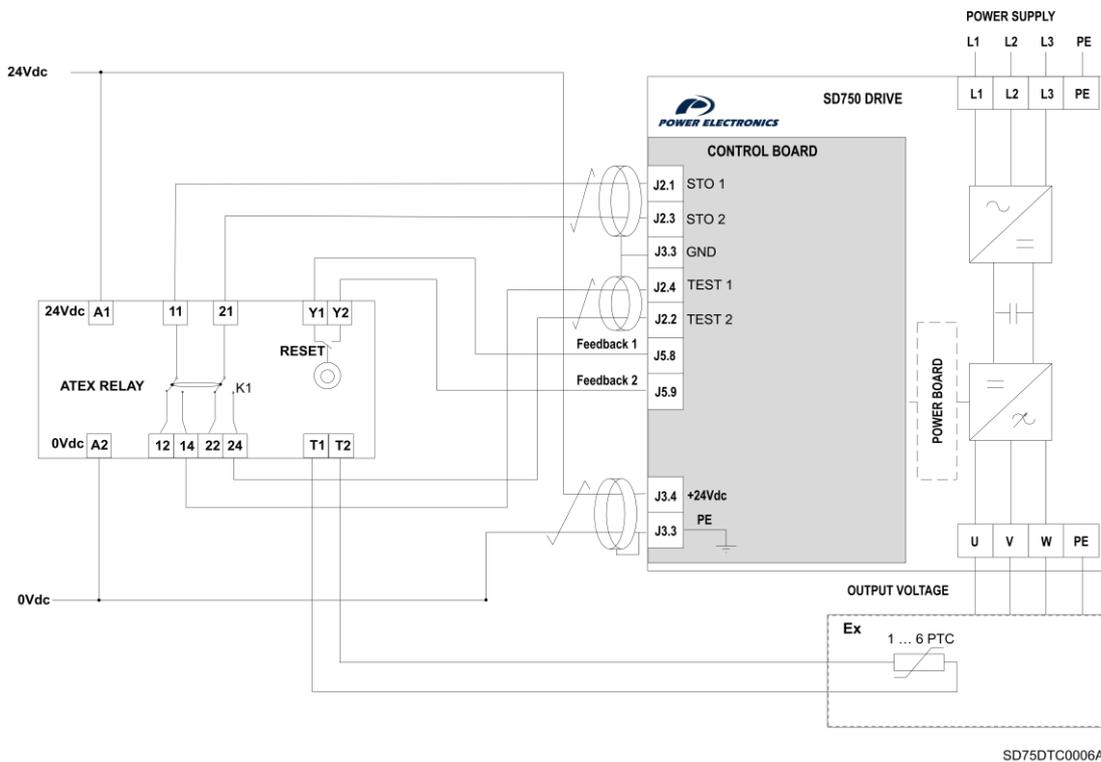
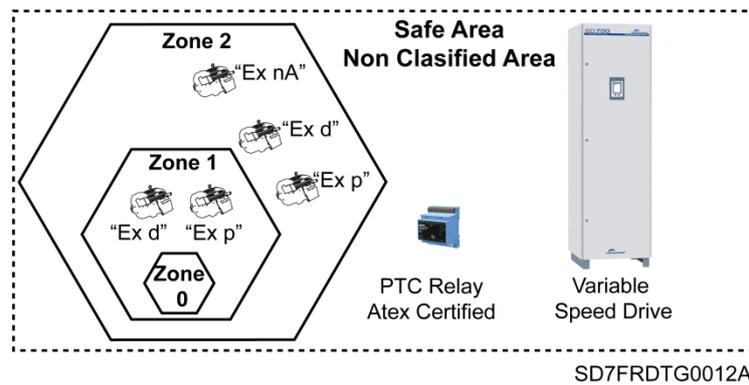
Do not use the STO function as a normal drive stop.

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Connection with ATEX motors

The ATEX standard is related to the use of machinery, installations and equipment in areas with a potentially explosive atmosphere. In the European Union, the use of equipment in these areas. Is regulated by two complementary directives: Directive 1999/92/EC for the installation environment and worker’s protection, and Directive 94/9/EC for the ATEX equipment. These guidelines and directives are based on two basic concepts: the classification of potentially explosive areas or zones and the limitation of equipment that can be installed in each of them.

Power Electronics provides a solution for driving ATEX motors such as “Ex nA”, “Ex d” and “Ex p” under the ATEX zone areas illustrated below. For different motor and ATEX zone combinations, consult Power Electronics.



As shown in the figure above, the SD750FR drive and the ATEX relay must be installed in a safe zone, outside the ATEX zone. This solution is valid for motors with "Ex d" or "Ex p" protection installed in zones 1 and 2, or motors with "EX nA" protection installed in zone 2. The external relay must be certified for ATEX zones and Must be compatible with the following features: 24 Vdc power supply voltage, 2 safety inputs, at least 2 open contacts and reset function. (Example: ZIEHL - PTC MSR 220Vi).

The SD750FR series features a dV/dt filter and a unique CLAMP¹ system that reduces dV/dt and voltage peaks in the motor windings. This reduces the risk of voltage leaks in the windings, motor overheating and leakage currents through the bearings. In addition, it is possible to regulate the thermal protection of the motor, thus increasing the protection against overheating in the motor. In self-ventilated motors, the inverter may require an oversizing according to the derating curves provided by the motor manufacturer.

¹ Only in equipment with rated voltage of 690 Vac.

9. MODBUS COMMUNICATION

9

Introduction

To guarantee a correct operation of the drive, peripheral elements must be correctly selected and properly connected. A wrong installation and / or application could cause a wrong operation of the system or a reduction of the long life of the equipment, as well as damage to the components. This manual should be read and understood carefully before proceeding.

The purpose of the Serial Communication Bus of the SD750FR drive is to integrate the drive itself into a network compatible with the Modbus communications protocol. This is possible using the physical communications ports RS485, Ethernet or USB port.

The Modbus communications system allows the SD750FR drive to be controlled and / or monitored as a slave by a Modbus master from a remote location.

The RS485 network allows to connect up to 240 computers on the same network.

The SD750FR drive operates as a peripheral slave when connected to a Modbus system. This means that the drive does not initiate the communication task, the master will start the task instead.

Virtually all of the drive operating modes, parameters and drive characteristics are accessible through serial communications. As an example, the master can give command to start and stop the drive, check the status of the SD750FR, read the current consumed by the motor, etc. The master mode can access all the possibilities of the drive.

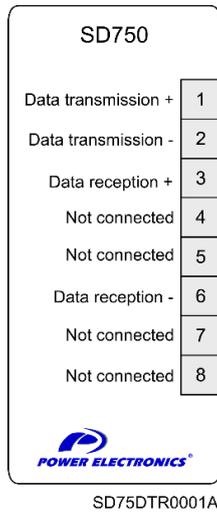
Hardware technical specifications

ETHERNET	Physical level	8 cables, half and full duplex, RJ45 ending
	Terminals	1 → Transmission data +
		2 → Transmission data -
		3 → Reception data +
		4 → Not connected
		5 → Not connected
		6 → Reception data -
		7 → Not connected
		8 → Not connected
	Type of wiring	Ethernet 10Base-T, Ethernet 100Base-TX
Data Interconnection Protocol	Modbus TCP/IP, Ethernet/IP Supports DHCP auto-addressing	
Data Transfer Rate	10Mbps, 100Mbps, auto-negotiation 10 / 100	
Compliance Standards	IEEE 802.3, IEEE 802.3u (only for 100Base-TX)	
Maximum cable length	100m per network segment	
RS485	Physical level	2 cables, optically insulated, half duplex, RS485 differential mode
	Terminals	27 → RS485 A (negative)
		28 → RS485 B (positive)
		29 → RS Common (0VDC)
	Output signal level	'1' logical = +5V differential
		'0' logical = -5V differential
	Input signal level	'1' logical = +5V differential
		'0' logical = -5V differential
	Insulation	± 50VDC regarding to the earth
	Programmable inputs via Modbus	7 digital inputs
2 programmable analogue inputs (0 – 10V, ±10V, 0 – 20mA, 4 – 20mA)		
Programmable outputs via Modbus	3 relay outputs	
	2 programmable analogue outputs (0 – 10V, ±10V, 0 – 20mA, 4 – 20mA)	
Max. number of SD750FR in network	240	
Maximum cable length	1000m	
USB	Connector: USB 1.1 and 2.0 type B. Controller FTDI chip Model FT232BM	For the correct operation of the USB connection, it is necessary to install the proper drivers. To this, simply access to the information of the appropriate model in: http://www.ftdichip.com/Drivers/VCP.htm From this site you can download the required files and complete their correct installation.

Note: For the installation of the driver in the Host of the SD750FR USB, it is only necessary to indicate the driver at the time of the installation. The USB device will be detected by the operating systems XP or later versions. In case of operating systems before W98 / Me, execute a search of new Hardware in the device administrator and complete the installation by indicating the drivers when the computer requires them.

Ethernet connection

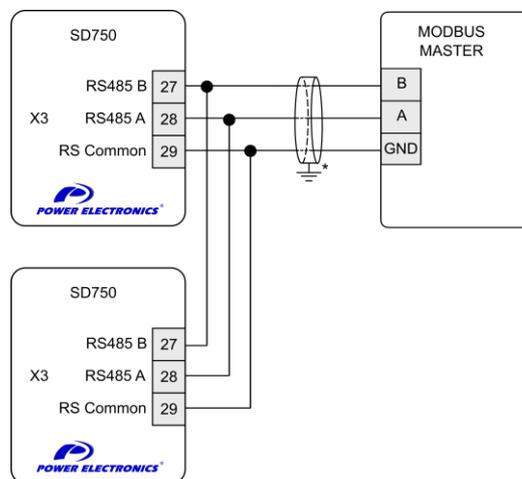
The following diagram shows the common wiring for an Ethernet connection:



To configure the connection, it is necessary to define the port and default IP address, among others. Refer to the Software and Programming Manual.

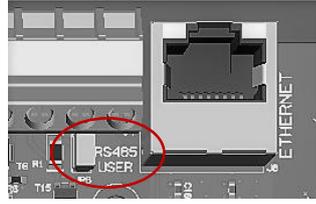
RS485 connection

The following diagram shows a common wiring for a RS485 connection:



* Screen connection must be performed on the side of the Modbus master or on the other side depending on the installation.
SD75DTR0002CI

It is recommended to connect the jumper “RS485 USER” at the first and the last device of the RS485 communication network, to connect the end of line resistor.



To configure the connection, it is necessary to define the port and default IP address, among others. Refer to the *Software and Programming Manual*.

10. COMMISSIONING

10



CAUTION

Only qualified personnel are allowed to commission the drive. Read carefully and follow the safety instructions of this manual.

Failure to do so may result in damage to the equipment and you may suffer an electric shock.

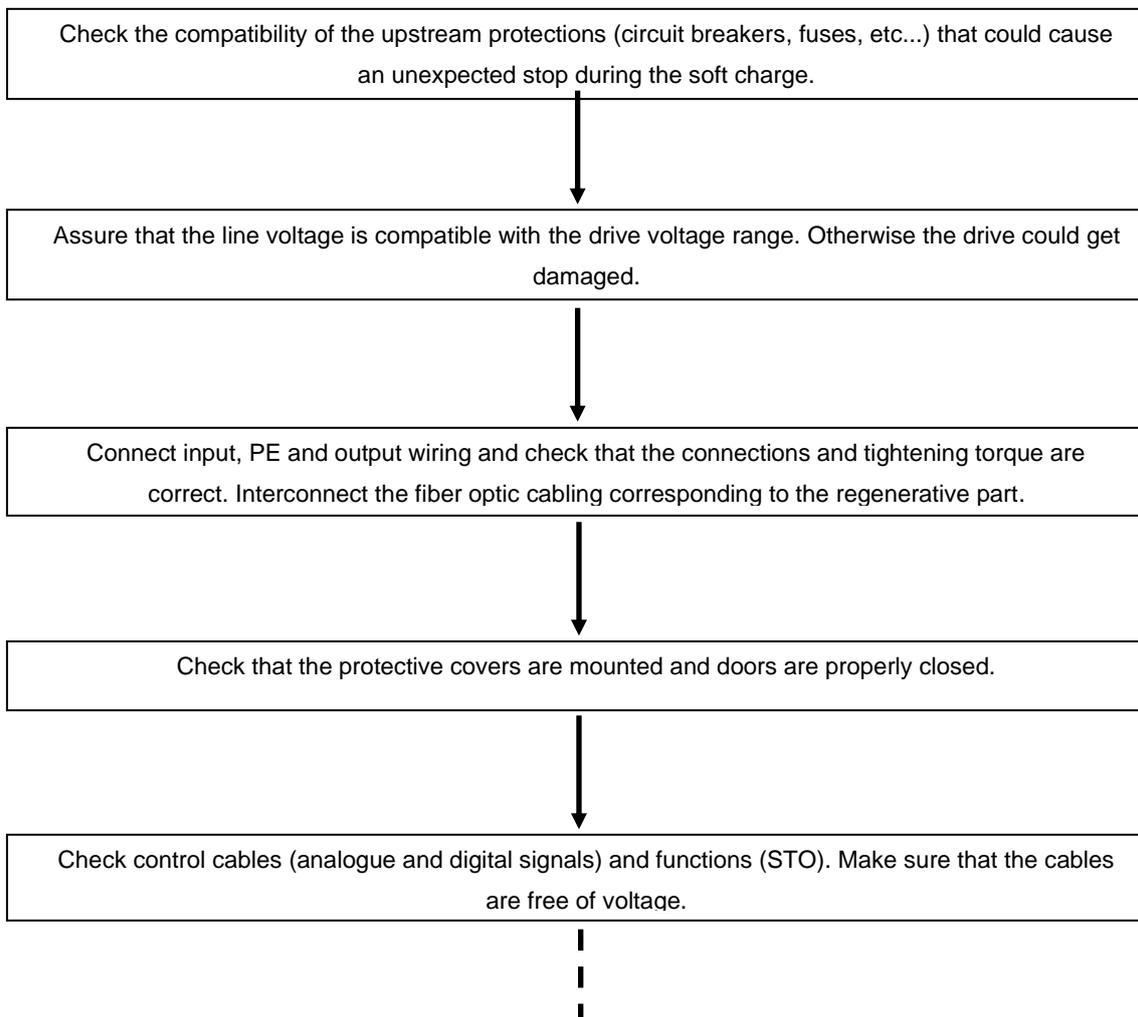
Make sure that there is no voltage at the power terminals. Make sure that voltage is not connected to the computer unexpectedly.

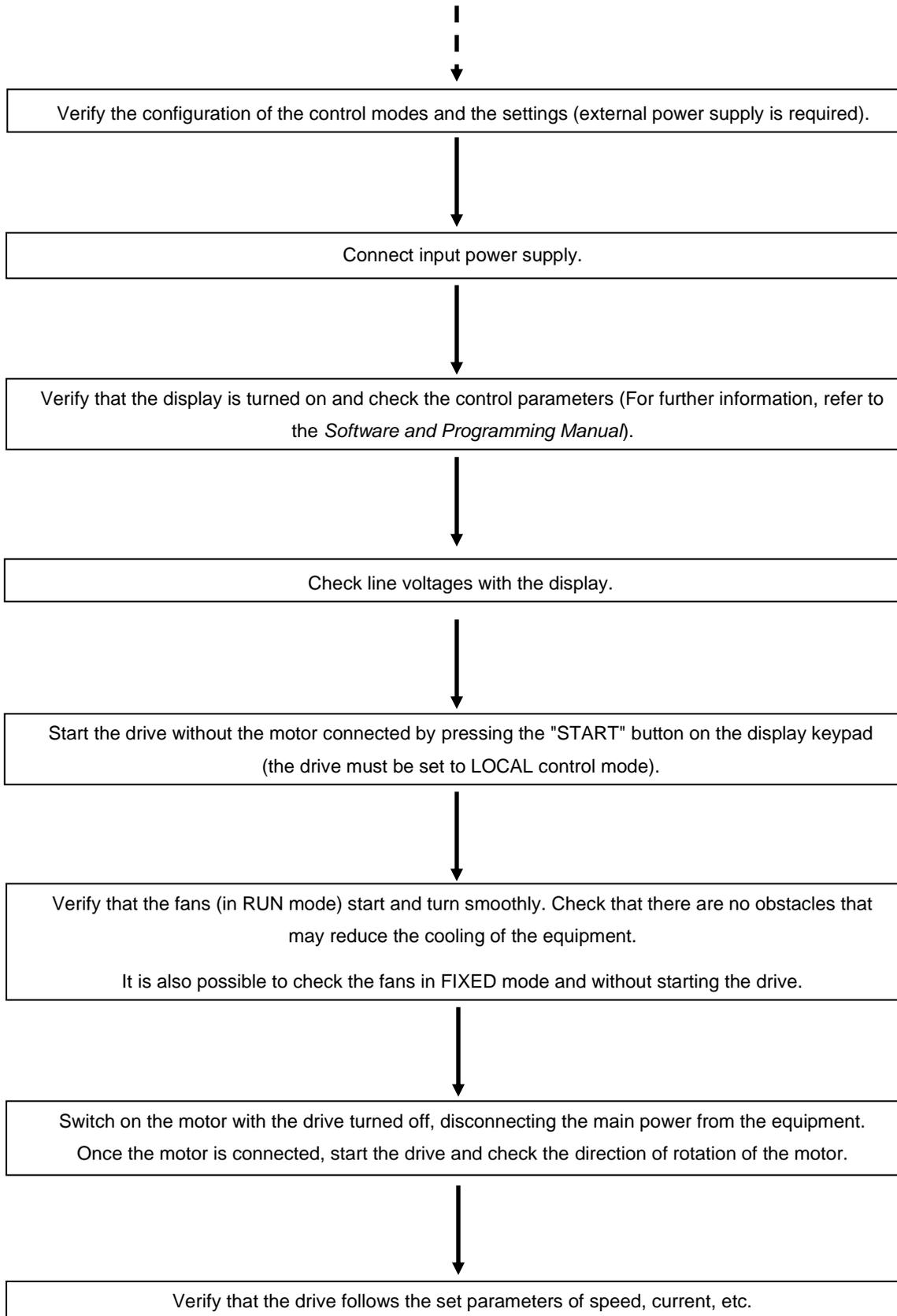
This section does not include all the tasks to be performed during the commissioning of the equipment. Follow local and national regulations.

If the equipment is stored for an extended period (more than 6 months) before installation, the recommendations from section "[Extended storage](#)" must be taken into account.

Ensure all the instructions on such section have been followed before starting the commissioning of the equipment.

For a proper commissioning, follow the next steps:





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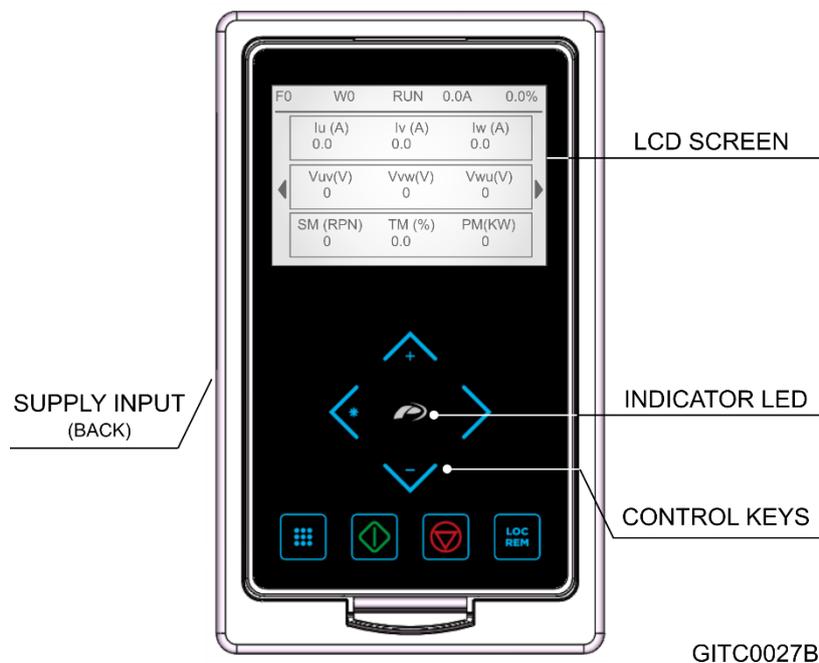
11. USE OF THE DISPLAY

11

The SD750FR drive has two types of screens, a monochrome graphics and an optional, tactile and color. Both screens provide intuitive data presentation, easy navigation through the control parameters and allow thousands of customized configurations to be stored by the user.

Graphic display

The graphic display is a removable display unit for remote installation. It is shown in the following figure. There is a built-in LED indicator on the display that provides information on the operating status of the device. In addition, there is a 2.8" LCD screen and eight control keys.



The LED indicator generates three different colors depending on the status of the drive, which indicates the following information:

- Yellow: Warning
- Red: Fault
- Green: Running

12. MAINTENANCE

12

The SD750FR Series drives are industrial electronic products that contain advanced semiconductor elements. For this reason, temperature, humidity, vibrations and worn components can affect performance. To avoid any possible irregularities, it is recommended to carry out periodic inspections.



WARNING

Ensure to follow all instructions to safely carry out maintenance tasks.
Otherwise, you could cause damages to the equipment and personnel.

Warnings

Make sure to remove the input power while performing maintenance.

Make sure to perform maintenance after checking the DC Link capacitor has discharged. Check that the voltage between terminals +HVDC and -HVDC is below DC 30V. The bus capacitors in the drive main circuit can still be charged even after the power is turned off.

The correct output voltage of the drive can only be measured by using an RMS voltage meter. Others voltage meters, including digital voltage meters, are likely to display incorrect values caused by the high frequency PWM output voltage of the drive.

Routine Inspection

It is necessary to perform periodic inspections of the drive. The frequency of the tasks shown in the table below are recommended, the times indicated depend on the working conditions in each case.

Tasks with monthly recommendation must be performed, at least, every three months.

Make sure to check the following points before handling the drive:

- Installation site conditions.
- Drive cooling system conditions.
- Excessive vibrations or noise in the motor.
- Excessive overheating.
- Normal output current value on the monitor.

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Inspection site	Inspection element	Inspection	Period			Inspection method	Criterion	Instrument of Measurement
			Monthly	3 months	2 years			
All	Ambient conditions	Are there dust particles? Are the ambient temperature and the humidity within specification?	o			Visual check	Temperature: -30 to +50 (or 40°C) Humidity: below 95% non-condensing.	Thermometer, Hygrometer, Recorder.
	Module	Are there any abnormal noises or oscillations?	o			Visual and audible.	There are no anomalies.	
	Input power	Is the input power to the main circuit correct?	o			Measure the voltage between terminals L1, L2, L3 and GND.		Digital multimeter. Tester.
	Power connections	Are the Power terminals correctly fastened?		o		Measure the temperature and torque of the power connections	Fasten the bolts again one week after its start-up. Check that the temperature is homogeneous and below 70°C	Infrared thermometer, Torque key
Main circuit	Conductor/ Cable	Is the conductor corroded? Is the sheathing of the cable damaged?		o		Visual check.	No anomaly.	
	Terminal	Is any damage visible?		o		Visual check.	No anomaly.	
Main circuit	IGBT's module Diodes module and Rectifier	Check the resistance value between each one of the terminals			o	Disconnect the cables of the inverter and measure the resistance value between: L1, L2, L3, ⇔ VDC+, VDC- and U, V, W ⇔ VDC+, VDC- with a tester > 10kΩ		Digital multimeter. Analogue tester.
	Correct capacitor	Have fluid leakages been observed? Is the capacitor well fastened? Is any dilation or retraction sign observed? Measure the capacitance	o	o		Visual check. Measure the capacitance with a proper instrument.	No anomaly Capacitance higher than 85% of rated capacitance.	Instrument for measuring capacity.
	Input Inductances	Is there any liquid leak? Is there any overheated point?		o	o	Visual check. Measure the surface and connectors' temperature.	No anomaly. Check that the temperature is homogeneous and below 70°C	Infrared thermometer.
	Contactors	Is there any contactor chatter? Is the contact damaged?		o	o	Audible check. Visual check.	No anomaly.	
Control circuit and Protections	Operating check	Is there any imbalance between output voltage phases?		o		Measure voltage between output terminals U, V and W.	Balanced voltage between phases i.e. lower than 8V difference for 400V models.	Digital multimeter / RMS voltage meter.
Cooling system	Cooling fans	Are there any abnormal noises or oscillations? Is the cooling fan disconnected?	o	o		Disconnect the power supply (OFF) and rotate the fan manually. Check the connections.	Fan should rotate effortlessly. No anomaly.	
	Dust filters	Are the dust filters obstructed?		o		Visual check	No anomaly	

Inspection site	Inspection element	Inspection	Period			Inspection method	Criterion	Instrument of Measurement
			Monthly	3 months	2 years			
Display	Measurement	Is the displayed value correct?	o	o		Check the reading instrument with an external measurement.	Check the specified values and the control values.	Voltage meter / Current meter etc.
Motor	All	Is there any noise or abnormal vibrations? Has any unusual smell been perceived?	o			Audible, sensory and visual check. Check if damages have been produced by overheating.	No anomaly.	
	Insulation resistance	Megger check (between terminals of output circuit and ground terminal)			o	Disconnect the cables U, V and W and join them together. Check the resistance between this join and ground.	More than 5M Ω	Megger type 500V

Note: Long life of the main components above indicated are based on a continuous operation for the stipulated load. These conditions can change according to the environment conditions.

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13. ACCESSORIES

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Codes and description

CODE	DESCRIPTION
SD75ET	Ethernet/IP communication board
SD75PN	Profinet communication board.
SD75PB	Profibus communication board.
SD75EC	Encoder board. It allows connecting 1 differential Encoder in TTL or HTL, from 5 to 24VDC.
SD75DIO	Digital Inputs / Outputs Expansion board. It allows increasing the number of inputs and outputs of the drive. It includes: <ul style="list-style-type: none"> • 5 Programmable Digital Inputs optically isolated. • 5 Digital Outputs (Relays).
SD75AIO	Analogue Inputs / Outputs Expansion board. It allows increasing the number of inputs and outputs of the drive. It includes: <ul style="list-style-type: none"> • 2 Programmable Analogue Input. • 2 Programmable Analogue Output.
SD75FO	Fiber Optic board. It allows communication between multiple drives in a master slave configuration. This board is optional for drives frame 5 to 8. For frames 9 to 11, it is supplied by default, along with the modules connection kit.
SD75PT	Board for 8 thermal probes type PT100 or PT1000 (configurable).
SD75DE3	Kit 3 meters Extender for Display.

Communication boards

SD750FR family is compatible with the most commonly used communication protocols (Profibus-DP, Profinet, Modbus TCP, Ethernet IP, Field Bus, etc.), thanks to its optional boards.

Refer to the specific manual of each board for further information.

Expansion boards

SD750FR series is compatible with the most commonly used communication protocols (Profibus, Profinet, Ethernet I/P, ...), thanks to its optional boards.

14. CE MARKING

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The CE Marking is a system to identify equipment that complies with the relevant directives (EMC directive). CE marking guarantees the free movement of the product within the EEA. CE marking shows that the product complies with technical safety, compatibility issues and conformity assessment.

EMC Directive

The EMC Directive defines the requirements for immunity and emissions of electrical equipment used within the European Union. SD750FR Series drives are in accordance with the directive IEC 61800-3:2004 about adjustable speed electrical power drive systems.

Low voltage directive

The low voltage directive defines the security requirements of low voltage electrical equipment in order to circulate freely within the European Economic Area. SD750FR Series drives are in accordance with the directive IEC 61800-5-1:2007 about adjustable speed electrical power drive systems.

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